3.0.3.2.1 Inservice Inspection Program (ISI) Program

Summary of Technical Information in the Application In LRA Section B.2.1, the applicant described the ISI Program as an existing program that is consistent, with an exception, to the GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The applicant stated that the program is in accordance with the requirements of ASME Code Section XI, Division 1, Subsections IWA, IWB, IWC, IWD, IWE, IWF, IWL, 1998 Edition through the 2000 Addenda, Mandatory Appendices, Inspection Program B of IWA-2432, and approved ASME Code Cases.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff also confirmed that the applicant's program contains all of the elements of the GALL Report. The staff conducted onsite interviews with the applicant to confirm these results.

The staff noted the applicant had indicated that the current scope of the program applies to the ASME Code Section XI, 1998 Edition, inclusive of the 2000 Addenda. The program description in the GALL AMP XI.M1 states that the GALL Report applies to inspection, repair, and replacement activities for ASME Code components covered in the ASME Code Section XI, 2001 Edition, inclusive of the 2003 Addenda. The staff noted that the applicant clarified that the use of the ASME Code Section XI, 1998 Edition, inclusive of the 2000 Addenda, is consistent with the program description statement in GALL AMP XI.M1 because the SOC on 10 CFR Part 54 clarifies that acceptable editions of the ASME Code Section XI are those acceptable endorsed editions of the ASME Code Section XI up through the most recently endorsed edition of the Code mentioned in 10 CFR 50.55a. The staff verified that the SOC on 10 CFR Part 54 does include this clarification, and that based on this clarification, use of the ASME Code Section XI, 1998 Edition, inclusive of the 2000 Addenda, is consistent with the Code edition mentioned in the program description of GALL AMP XI.M1. Based on this review, the staff finds the applicant's crediting of the ASME Code Section XI, 1998 Edition, inclusive of the 2000 Addenda (for aging management) is consistent with the criteria in GALL AMP XI.M1.

In comparing the elements in the applicant's program to those in the GALL AMP XI.M1, the staff noted the program elements in the applicant's AMP claim of consistency with the GALL Report were consistent with the GALL AMP XI.M1 with the exception of program elements aspects identified below. The staff determined that additional information was required to complete its review.

The staff noted that the applicant had not identified the parameters or aging effect that the program manages in either the "scope of program," "parameters monitored/inspected," or "detection of aging effects" program elements for the AMP.

In RAI B.2.1-1, dated June 12, 2008, the staff requested that the applicant identify the parameters or aging effects that are within the scope of and are managed by the ISI Program.

In the response to RAI B.2.1-1, dated July 14, 2008, the applicant stated that during the period of extended operation, the ISI Program is credited to manage the following aging effects/mechanisms for components within the reactor coolant system, including the RV and RV internals:

- Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, and irradiation-assisted stress corrosion cracking
- Loss of material due to general, pitting, and crevice corrosion
- Loss of fracture toughness due to thermal aging embrittlement of CASS components

The applicant also stated that loss of fracture toughness due to thermal aging embrittlement of CASS components is managed via the detection of cracking and the monitoring of crack growth.

The staff finds the applicant's response partially addressed the staff's inquiry raised in RAI B.2.1-1, because the applicant has identified the aging effects managed by the ISI Program. However, the staff noted that, in LRA Table 3.1.2-3, the applicant credits the ISI Program to manage loss of fracture toughness of CASS recirculation pump thermal barriers. The staff also noted that the thermal barriers in the pumps (which provide a Class 1 to Class 2 interface) may not actually be accessible for inspection. The staff further noted that UT volumetric techniques, to date, cannot distinguish between UT signals that come from the CASS microstructures, from those that result from crack and/or flaw indications in the CASS material. Given that thermal aging of CASS can lead to a lower fracture toughness and cracking, the staff issued a follow-up RAI.

In RAI B.2.1-1R, dated October 27, 2008, the staff requested that the applicant describe the aging management of the primary recirculation pump CASS thermal barrier cover, specifically addressing the aging management of cracking that could occur between the pump shaft cavity and the reactor building closed-cooling water (RBCCW) cooling water cavity; and identify what inspection techniques will be used to perform these inspections.

In the response to RAI B.2.1-1R, dated November 17, 2008, the applicant stated that the use of the ISI Program to manage the aging effect of thermal aging embrittlement is consistent with the GALL Report Item IV.C1-3, for Class 1 pump casings. The applicant further stated that PPL identified the thermal barrier as a separate component of the pump, even though it is part of the pump cover. The applicant further stated that the pump cover has a series of passages, created by machining and drilling, to allow cooling water, from the RBCCW system, to be circulated through the portion of the casing that surrounds the pump shaft, and that the portion of the pump cover that contains these passages and performs the cooling function is called the thermal barrier. The applicant also stated that since the thermal barrier is the same cast component as the pump cover, the ISI Program is also credited for managing loss of fracture toughness for the RCPB of the thermal barrier, which includes the portion of the pump cover between the pump shaft cavity and the cooling water cavity of the RBCCW system.

The staff reviewed the applicant's response and noted that GALL Report Item IV.C1-3 states that programs corresponding to the GALL AMP XI.M1 are acceptable programs to credit for management of loss of fracture toughness in ASME Code Class 1 CASS pump casings. The staff noted that, like the pump casings, the CASS pump covers also provide a portion of the RCPB portions of the pumps. The staff finds that since the thermal barrier is part of the pump cover, the use of this AMP to manage the aging effects of the pump cover is an acceptable equivalency for managing the aging effect of the thermal barrier, which is normally not accessible.

Based on the review, the staff finds the applicant's response to RAI B.2.1-1R acceptable because the applicant has adequately described the aging management of the primary

recirculation pump CASS thermal barrier cover and has identified the inspection techniques it will use to perform these inspections. On the basis that the thermal barrier is part of the recirculation pump cover and that the GALL Report Item IV.C1-3 recommends that the ISI Program be credited to manage reduction of fracture toughness of CASS recirculation pump casings and covers, the staff also finds the applicant's basis for crediting the ISI program for aging management of reduction of fracture toughness to be acceptable for these components. Therefore, the staff's concerns described in RAI B.2.1-1R are resolved.

The staff noted that the license renewal basis document for the ISI Program indicates that the criteria, in particular staff-approved BWRVIP reports, may be used in lieu of applicable ASME Code Section XI ISI requirements for ASME Code Class 1, 2, or 3 components.

In RAI B.2.1-2, dated June 12, 2008, the staff requested that the applicant address the basis for crediting the BWRVIP report criteria in lieu of the ASME Code Section XI requirements that are implemented under the ISI Program and for requesting clarification whether or not proposals to use staff-approved BWRVIP guideline criteria in lieu of applicable ASME Code Section XI requirements will be submitted for staff approval.

In the response to RAI B.2.1-2, dated July 14, 2008, the applicant stated that all proposals to use staff-approved BWRVIP guideline criteria in lieu of applicable ASME Code Section XI requirements will be submitted for staff approval as part of the relief request submittals for each 10-year ISI Inspection Plan, in accordance with 10 CFR 50.55a.

Based on the review, the staff finds the applicant's response to RAI B.2.1-2 acceptable because the applicant has confirmed that it will submit all proposals to use BWRVIP guidance criteria in lieu of ASME Code Section XI requirements for staff approval as part of 10 CFR 50.55a(a)(3) relief requests for the 10-year ISI Plans. Therefore, the staff's concern described in RAI B.2.1-2 is resolved.

The staff noted that the "corrective actions" program element discussion in the basis document for the ISI Program indicates that the corrective actions for the program will be implemented through implementation of the applicant's 10 CFR Part 50, Appendix B, Quality Assurance Program.

In RAI B.2.1-3, dated June 12, 2008, the staff requested that the applicant clarify how implementation of the SSES 10 CFR Part 50, Appendix B, Quality Assurance Program will ensure that the corrective actions for ASME Code Class 1, 2, or 3 components will be implemented, in accordance with applicable corrective actions in ASME Code Section XI Article IWB-3000, or its sub-articles, paragraphs, or subparagraphs; in staff-approved ASME Code Cases endorsed for use in the latest staff-issued version of RG 1.147; or through the staff's relief request process defined in 10 CFR 50.55a.

In the response to RAI B.2.1-3, dated July 14, 2008, the applicant stated that the ISI Program and governing procedures specify compliance with ASME Code Section XI corrective actions for defects found in Class 1, 2, or 3 components and includes use of the acceptance standards in the applicable sections of IWB-3000. The applicant also stated that the approved 10-Year ISI plan describes the use of staff-approved ASME Code Cases endorsed for use in the latest staff-issued version of RG 1.147 and when alternative standards are necessary, staff approval is obtained through the NRC Relief Request process.

The applicant further stated that the QA program specifies audits of the ISI Program every two years, following established auditing procedures, and that these audits are conducted in accordance with assessment basis documents that provide guidelines specific to the addressed topic. The applicant clarified that the SSES audit guideline for the ISI Program explicitly addresses compliance with 10 CFR 50.55a and related regulatory requirements and commitments.

The staff reviewed the response and noted that the ISI Program specifies compliance with ASME Code Section XI corrective actions, including acceptance standards in the applicable sections of IWB-3000. Furthermore, the staff noted that the applicant performs QA audits of its ISI Program every two years as required by the QA program, and verified that these QA audits are performed to ensure the corrective actions for the program are implemented in accordance with the corrective actions requirements in the ASME Code Section XI, staff-approved ASME Code Cases, or in accordance with acceptable alternative correction action programs requested and approved through the staff's 10 CFR 50.55a(a)(3) alternative ISI program process (i.e., through the staff's ISI program relief request process).

Based on this review, the staff finds the applicant's response to RAI B.2.1-3 acceptable because the applicant has implemented its QA program to ensure that the corrective actions are in compliance with either 10 CFR 50.55a and applicable ASME Code Section XI corrective action requirements, staff-approved ASME Code Cases, or acceptable alternative correction action programs that are approved through the staff's 10 CFR 50.55a(a)(3) alternative ISI program process, and because the applicant's program conforms to the recommendations in the "corrective actions" program element in the GALL AMP XI.M1. Therefore, the staff's concerns described in RAI B.2.1-3 are resolved.

Exception 1. The applicant has taken an exception to the "detection of aging effects" program element in the GALL AMP XI.M1. In this exception, the applicant proposed to use a risk-informed ISI methodology in lieu of the ASME Code Section XI tables for determining the inspection samples of particular ASME Code Class welds.

The staff noted that use of risk-informed ISI methodologies and programs must be requested and approved by the staff, in accordance with the staff's alternative program relief request provisions in 10 CFR 50.55a(a)(3). Consistent with this requirement, the staff makes the following statement in Chapter 1 of the GALL Report, Revision 1, Volume 2, for proposals to use alternative programs in lieu of complying with applicable ASME Code Section XI requirements:

> If an applicant seeks relief from specific requirements of 10 CFR 50.55a and Section XI of the ASME Code for the period of extended operation, the applicant will need to re-apply for relief through the 10 CFR 50.55a relief request process once the operating license for the facility has been renewed.

The staff verified that the risk-informed ISI program for Units 1 and 2 was approved in a staff-issued SE dated September 28, 2005. The staff also noted that the risk-informed ISI program relief request was only approved for the 3rd 10-Year ISI interval for Units 1 and 2 and that risk-informed ISI has yet to be proposed and approved for any of the 10-Year ISI intervals within the scope of the period of extended operation for Units 1 and 2.

In RAI B.2.1-5, dated June 12, 2008, the staff requested that the applicant commit to request relief for use of risk-informed ISI within 12 months before the start of each 10-Year ISI interval, if the applicant was planning on using a risk-informed ISI methodology for the 4th 10-Year ISI intervals or subsequent 10-Year ISI intervals for Units 1 and 2.

In the response to RAI B.2.1-5, dated July 14, 2008, the applicant revised the LRA to remove the statement that identifies the use of risk-informed ISI as an exception to the GALL AMP XI.M1. The applicant stated that since the use of risk-informed ISI at SSES must be approved pursuant to 10 CFR 50.55a(a)(3), it is not considered to be an exception to the GALL Report.

Based on its review, the staff finds the applicant's response to RAI B.2.1-5 acceptable because the applicant has removed the use of risk-informed ISI as an exception to the GALL Report. The staff determines that the applicant need not make an LRA commitment to request relief for the use of risk-informed ISI in future intervals because the applicant is already committed to seek approval for the use of risk-informed ISI, in accordance with 10 CFR 50.55a(a)(3). Therefore, the staff's concern described in RAI B.2.1-5 is resolved.

Based on its review, the staff finds the applicant's ISI Program consistent with the program elements of the GALL AMP XI.M1 and therefore is acceptable.

Operating Experience. The staff reviewed the applicant's OE basis document for safety significant OE relevant to the aging management of ASME Code Class 1, 2, and 3 components. The staff noted that the applicant only provided an overall OE summary statement in the "operating experience" program element for the Inservice Inspection Program and did not provide any examples of SSES specific and generic OE that would demonstrate that the AMP is accomplishing its intended objective.

During the onsite review of this AMP, the staff determined the license renewal basis binder for the Inservice Inspection Program included two CRs on circumferential flaw indications that were recorded for the safe end welds of the Unit 1 N2J recirculation outlet nozzle and N1B recirculation inlet nozzle, resulting from previous augmented UT examinations performed on these weld locations. The staff noted that the augmented inspections of these safe-end welds are credited in accordance with the BWR Stress Corrosion Cracking Program, and are implemented through augmented inspections performed under the ISI Program. The staff determined that these CRs are significant because the applicable safe-end welds are ASME Code Class 1 RCPB locations, and because a complete circumferential weld failure of the nozzle safe-end components could result in a loss-of-coolant accident for the facility.

Thus, even though the staff verified that the applicant had listed the experience as relevant OE for the BWR Stress Corrosion Cracking Program and had taken appropriate corrective actions of the flaw indications by performing weld overlays of the components, the staff felt that the applicant should have mentioned these flaw indications as relevant OE for the Inservice Inspection Program, in the same manner that the CRs were listed as relevant OE for the BWR Stress Corrosion Cracking Program. The staff also noted that the applicant did not specify which staff-approved weld overlay methodology was applied to the repair of the flaw indications (i.e., cracks) in the recirculation inlet and outlet nozzles.

In RAI B.2.1-4, part a, dated June 12, 2008, the staff requested that the applicant amend the LRA to list these circumferential crack safe-end nozzle events as relevant OE for the "operating experience" program element in ISI Program. In RAI B.2.1-4, part b, the staff requested that the

applicant identify the particular weld overlay methodology (along with its reference basis) used for the repairs of these safe-end nozzle indications, and clarify whether the overlay methodology required a flaw tolerance evaluation of the flaw indications and; if so, explain whether the analysis is a time-limited aging analysis (TLAA) for the application.

In the response to RAI B.2.1-4, part a, dated July 14, 2008, the applicant amended the LRA to add the relevant experience of the ultrasonic inspection of the N1B and N2J recirculation nozzle-safe end welds that revealed indications which were determined to be flaws. These welds are dissimilar metal welds and the indications were typical of SCC in Alloy 82/182 weld material.

The applicant stated that the flaws were repaired using full-structural weld overlays, based on the standard weld overlay defined in NUREG-0313, Revision 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," and the weld overlay design was based on the requirements of ASME Code Section XI, IWB-3640 and Code Case N-504-2. The applicant further stated that the weld overlays were applied using Inconel 52, a material highly resistant to IGSCC, and that subsequent inspections performed in 2008, indicated no cracking in the weld overlays at the N1B and N2J nozzle-safe end weld locations.

In response to part b, the applicant stated:

> The flaws were repaired using full structural weld overlays that were designed to bound all cracking conditions in the nozzle-safe end (NOZ-SE) weld area, using the Standard Weld Overlay defined in NUREG-0313, Revision 2. The weld overlay design was based on the requirements of ASME Section XI, IWB-3640 and Code Case N-504-2. The weld overlay design conservatively assumed the flaws were through-wall and extended entirely around the pipe. No credit was taken for any remaining ligament in the original NOZ-SE welds. The weld overlays were applied using Inconel 52, a material highly resistant to IGSCC. The overlay welding methods result in compressive loads on the area beneath the overlay, thereby limiting the potential for further growth of the existing flaws. The overlay design also included a crack initiation and growth analysis, which demonstrated that the overlay will have a very low susceptibility for crack initiation and growth during the life of repair, due to the high IGSCC-resistance of the Inconel 52 alloy used in the overlay. Post-repair inspections assured the quality of the repair, and ongoing inspection requirements for the overlay and the underlying base material will identify any future degradation. The ASME Code required no flaw tolerance evaluations to be performed as part of the design basis for these repairs. There were no design basis analyses performed for the weld overlay repairs that constitute a TLAA.

The staff reviewed the applicant's response and noted that specific plant OE was identified. The applicant also provided the methodology used to perform the weld overlay repair. The staff concurs that use of Inconel 52 as weld material will provide a very low susceptibility for crack initiation and growth. Since no design basis analyses were performed and because ongoing inspections will be performed to manage aging, the staff finds that there are no TLAAs to be evaluated. However, Paragraph (g) of the Code Case mandates performance of an evaluation of the flaws that are left in place as part of the alternative repair weld overlay technology required by ASME Code.

In follow-up RAI B.2.1-4R, dated October 27, 2008, the staff requested that the applicant explain what it did to meet paragraph (g) of staff-approved ASME Code Case N-504-2, and whether a flaw growth assessment was performed in accordance with the Code Case, to clarify whether the flaw tolerance evaluation was effective for the remainder of the current licensed lives of Units 1 and 2.

In the response to RAI B.2.1-4R, dated November 17, 2008, the applicant stated:

> The weld overlay repairs for the SSES Unit 1 N1B and N2J recirculation nozzle-to-safe-end welds were designed to the requirements of ASME Section XI, IWB-3640 and Code Case N-504-2. Additionally, the repairs were "full structural overlays," or Standard Weld Overlays, as defined in Section 4.4 of NUREG-0313 Revision 2. As such, the overlay repairs were designed with the assumption that the underlying flaw was entirely through-wall and completely around the circumference of the component. No credit was taken for any remaining ligament in the repair location. The design of the overlays provides the necessary wall thickness to satisfy the flaw evaluation procedures of IWB-3640, in accordance with Code Case N-504-2 paragraph (f)(1), and ensures the structural adequacy of the component for all design loading conditions. This design approach is consistent with hundreds of similar overlay repairs on BWR recirculation nozzles and other IGSCC-susceptible components in the industry since 1985.
>
> When the overlays were designed, there was conclusive evidence from past and present volumetric examinations that flaw growth had been arrested by the application of the Mechanical Stress Improvement Process (MSIP) in 1993 (for the N2J) and 1995 (for the N1B). The volumetric examination data was Reviewed by PPL, General Electric, and EPRI NDE experts. The consensus conclusion was that the flaws had not grown since the application of MSIP. The lack of flaw growth between the time of MSIP application and 2004 confirmed that the residual compressive stress in the welds from MSIP, combined with the benefits of HWC implementation in January 1999, had effectively eliminated further IGSCC. It was also recognized that weld overlay repairs would impose additional compressive stress in the welds. Therefore, it was concluded that there would be no, or negligible, flaw growth due to IGSCC into the future.
>
> Since there was no flaw growth projected to exceed the assumed flaw in the overlay design, a flaw growth assessment and a flaw tolerance evaluation to demonstrate the structural adequacy for a predicted flaw size at the end of a specific operating interval (e.g., 40 years or 60 years) were not necessary. The full structural overlay, as designed with an assumed through-wall crack around the entire circumference in accordance with IWB-3640 and Code Case N-504-2, will remain structurally adequate for the operating life of the plant.
>
> Code Case N-504-2 paragraph (g)(2) requires a weld repair evaluation to demonstrate that the requirements of IWB-3640 are satisfied for the design life of the repair, considering potential flaw growth. As discussed above, the potential flaw growth was determined to be zero, or negligible, such that the flaw assumed in the overlay design remains bounding for the life of the component. Therefore,

the calculations performed to determine the required design size and thickness of the overlays serves as the evaluation required by Code Case N-504-2 paragraph (g)(2). Since those calculations are not dependent on any flaw growth assessments, they are not time-limited aging analyses (TLAA).

The staff reviewed the applicant's response and Code Case N-504-2 paragraph (g)(2) and determined that the Code Case requires an assumed flaw size and a flaw growth analysis for the life of the plant. The staff noted that, for the applicant's full structural overlay repairs, the applicant assumed that the underlying flaw was entirely through wall and around the circumference, and no credit was taken for any remaining ligament. The staff also noted that the applicant indicated that the structural overlays place the flaw in the original weld material in compression, such that the growth of the flaw is mitigated from growing into the weld overlay repair material.

Based on the review, the staff finds the applicant's response to RAI B.2.1-4R acceptable because the applicant has provided an acceptable basis for concluding that structural overlays are an acceptable alternative repair for ASME Code Class piping components and that the overlays need not be within the scope of a TLAA, because they are implemented pursuant to staff-approved ASME Code Case and because the overlays place the original flaw in compression, such that the flaws are mitigated from growing into the overlay weld repair material. Therefore, the staff's concern described in RAI B.2.1-4R is resolved.

The staff confirmed that the OE program element satisfies the criterion defined in the GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. The applicant provided the UFSAR supplement summary for the ISI Program in LRA Section A1.2.23 and Commitment No. 1 in Table A-1. The staff reviewed this section and determines that the UFSAR supplement summary description for the ISI Program conforms to the staff's recommended UFSAR supplement SRP-LR Table 3.1-2. The staff finds that the applicant has committed (Commitment No. 1) to ongoing implementation of its ISI Program aging management of those in-scope components for which the AMP is credited and linked this commitment to UFSAR Supplement Summary Section A.1.2.23 for the ISI Program. Based on this review, the staff finds that UFSAR Supplement Summary Section A.1.2.23, when coupled to LRA Commitment No. 1, provides an acceptable UFSAR supplement summary description of the applicant's ISI Program.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of the audit and review of the applicant's ISI Program and the applicant's responses to the staff's RAIs, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d) and therefore is acceptable.

3.0.3.2.2 BWR CRD Return Line Nozzle Program

Summary of Technical Information in the Application. In LRA Section B.2.6, the applicant described the BWR Control Rod Drive (CRD) Return Line Nozzle Program as an existing program that is consistent with an exception with GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle." The applicant stated that the BWR CRD Return Line Nozzle Program monitors the effects of cracking on the intended function of the CRD return line nozzle by performing ISIs in conformance with the ASME Code, Section XI, Subsection IWB, Table IWB 2500-1.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also confirmed that the plant program contains all of the elements of the referenced the GALL Report. The staff conducted onsite interviews with the applicant to confirm these results.

Exception 1. The BWR CRD Return Line Nozzle Program takes an exception to the "acceptance criteria" program element to the GALL AMP XI.M6. In this exception the applicant proposed to use a weld overlay methodology as an alternative corrective action repair technique for flaws that are detected in the CRD return line nozzles or their pressure boundary welds, including the CRD return line cap-to-nozzle welds. The staff noted the applicant indicated that the weld overlay repair methodology will be implemented in accordance with the requirements of 10 CFR 50.55a. The staff also noted that the applicant did not indicate that this exception was applicable to the "corrective actions" program element for the BWR CRD Return Line Nozzle Program.

In RAI B.2.6-1, dated July 23, 2008, the staff requested that the applicant commit to perform an ASME Code Section XI repair of the leaking component, unless the weld overlay repair methodology is submitted for staff review and approval and is granted in accordance with the requirements of 10 CFR 50.55a(a)(3). The staff requested that the applicant provide the basis for not applying the exception on the weld overlay methodology to the "corrective actions" program element in the GALL AMP XI.M6.

In its response to RAI B.2.6-1, dated August 22, 2008, the applicant amended the LRA to revise the exception to the "acceptance criteria" element of LRA Section B.2.6 and to add to Commitment No. 6 the following:

> PPL will implement weld overlay repairs in accordance with ASME Section XI and NRC-approved Code Cases. If no NRC-approved Code Case exists for the weld overlay, PPL will obtain NRC approval prior to implementing the repair in accordance with 10 CFR 50.55a.

The applicant also provided a basis for not including an exception to the "corrective actions" program element in the GALL AMP XI.M6, stating:

> Any identified cracks or indications in the CRD return line nozzle are evaluated under the rules of ASME Section XI. If the evaluation determines that a repair is required, the design and implementation of the repair is governed by the SSES ASME Section XI repair program, which requires the repair to meet Code requirements unless relief is granted by the NRC. Furthermore, in accordance with the SSES ISI Program, when cracks or indications are identified, a condition report is written and, at that point, the SSES corrective action program also

controls the resolution of the condition. Both the SSES ASME Section XI repair program and the SSES corrective action program meet the requirements of 10 CFR 50, Appendix B.

The corrective action element of GALL XI.M6 includes the statement that "As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the corrective actions." Since the SSES ASME Section XI repair program and the SSES corrective action program both meet the requirements of 10 CFR 50, Appendix B, the corrective actions that would be taken in accordance with those programs are consistent with GALL.

Based on the review, the staff finds the applicant's response to RAI B.2.6-1 acceptable because the applicant has included a commitment for the implementation of weld overlays. The staff notes that the applicant evaluates any identified cracks or indications in compliance with ASME Code Section XI. The staff determines that the applicant's evaluation and repair is performed in accordance with ASME Code Section XI and along with the applicant's Corrective Action Program, both meet the requirements of 10 CFR Part 50, Appendix B. Therefore, the staff's concern described in RAI B.2.6.1 is resolved.

Based on the review, the staff finds the applicant's BWR CRD Return Line Nozzle Program acceptable because it conforms to the recommended GALL AMP XI.M6, with an exception.

Operating Experience. The staff reviewed the applicant's OE basis document for safety significant OE relevant to the aging management of CRD return line nozzle welds components. The staff noted in the OE discussion, the applicant indicated that, prior to initial startup of Units 1 and 2, the applicant cut and capped the CRD return line and the CRD return line nozzle to eliminate CRD return line flow from the plant design.

The staff finds this statement acceptable because it conforms to the criterion in the "preventative actions" program element of the GALL AMP XI.M6 which states that cutting and capping of CRD return lines, without rerouting the return line flow, is an acceptable mitigation technique for CRD return line nozzle programs.

The staff also noted that in the "operating experience" program element discussion for this AMP, the applicant stated that it has been implementing the required ASME Code Section XI inspections and the recommended augmented NUREG-0619, "BWR Feedwater Nozzle and Control Rod Driven Return Line Nozzle Cracking" inspections. The applicant further stated that to date, inspections of the capped CRD return line nozzles and the required surface examination and volumetric examinations did not indicate any evidence of flaw indications in the capped CRD return line nozzle inner blend radii or their associated ASME Code Class 1 welds. The staff verified that the applicant had implemented the recommended augmented UT and/or dye penetrate test (PT) inspections of the CRD return line cap-to-nozzle welds and nozzle inner blend radii that required inspection during the 11th and 12th RFOs for Unit 1 (*i.e*, U111RIO and U112RIO) and during the 9th RFO for Unit 2 (i.e., U209RIO). The staff verified that the applicant's UT and PT examinations of these CRD return line nozzle locations did not indicate the presence of any recordable flaw indications in the nozzle welds or inner blend radii.

Based on this review, the staff confirms that the applicant has been performing the augmented UT and PT inspections of CRD return line nozzle inner blend radii and cap-to-nozzle welds in accordance with its BWR CRD Return Line Nozzle Program. The staff further confirms that the

applicant's program has been implemented in accordance with an augmentation of the ISI Program requirements of ASME Code Section XI, as modified by the recommended augmented inspection criteria in NUREG-0619. Based on this review, the staff finds that the RFO and IRs provide acceptable confirmation that the applicant is implementing the recommended augmented inspections and that currently, there are no SSES-specific OE for the CRD return line nozzles or their associated pressure boundary welds, including the cap-to-nozzle welds.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. The applicant provided the UFSAR supplement summary for its BWR CRD Return Line Nozzle Program in LRA Section A.1.2.5 and Commitment No. 6 in Table A-1. The staff reviewed this section and confirms that the UFSAR supplement summary description for the BWR CRD Return Line Nozzle Program conforms to SRP-LR Table 3.1-2. The staff also confirms that the applicant has committed (Commitment No. 6) to ongoing implementation of the BWR CRD Return Line Nozzle Program for aging management of those SSES in-scope components for which the AMP is credited and linked this commitment to UFSAR Supplement Section A.1.2.23 for this AMP. In response to RAI B.2.6-1, dated August 22, 2008, the applicant revised Commitment No. 6 to state that if no staff-approved Code Case exists for the weld overlay; PPL will obtain staff approval, prior to implementing the repair pursuant to 10 CFR 50.55a.

Based on this review, the staff finds that UFSAR Supplement Section A.1.2.5, when coupled with LRA Commitment No. 6, provides an acceptable UFSAR supplement summary description of the applicant's BWR CRD Return Line Nozzle Program because it is consistent with the UFSAR supplement summary description in the SRP-LR.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's BWR CRD Return Line Nozzle Program and the applicant's response to the staff's RAI, the staff finds all program elements consistent with the GALL Report. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d) and therefore is acceptable.

3.0.3.2.3 BWR Penetrations Program

Summary of Technical Information in the Application. In LRA Section B.2.8, the applicant described the existing BWR Penetrations Program as consistent, with an exception, with the GALL AMP XI.M8, "BWR Penetrations." The applicant stated that this program is used to manage the effects of aging that are applicable to the RV penetration nozzle components and their associated penetration welds. The applicant also stated that the exception is taken on the "scope of program" program element in the GALL AMP XI.M8 to include the RV flange leakoff penetration nozzle, vessel drain penetration nozzle, CRD penetration nozzles, and incore flux

monitor penetration nozzles, as additional components that are within the scope of the AMP (i.e. in addition to the standby liquid control (SLC) nozzles and RV instrument penetration nozzles).

Staff Evaluation. During the audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception below to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report. The staff conducted onsite interviews with the applicant to confirm these results.

Exception. The staff noted that the applicant's program takes an exception to the "scope of program" program element to the GALL AMP XI.M8. In this exception, the applicant identified that the BWR Penetrations Program is credited for managing the effects of aging for the vessel flange leakoff penetration, RV drain penetrations, CRD penetrations, and incore flux monitor penetrations, in addition to the SLC/core ΔP nozzle and the RV instrumentation nozzles.

The applicant's BWR Penetrations Program is based on the recommended augmented inspection and flaw evaluation guidelines found in BWRVIP Proprietary Topical Report Nos. TR-107286 and TR-108695, "BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines (BWRVIP-27)" and "BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines (BWRVIP-49), " respectively. The staff approved BWRVIP-27 in a SE dated December 20, 1999. The staff approved BWRVIP-49 in a SE dated September 1, 1999 and noted that the scope of BWRVIP-27 is limited to SLC/core plate ΔP line nozzles and that the scope of BWRVIP-49 is limited to BWR instrument penetrations.

In RAI B.2.8-1, dated July 23, 2008, the staff requested that the applicant provide its basis for extending the scope of the GALL AMP XI.M8 to the RV flange leakoff line penetrations, RV drain penetrations, CRD penetrations, and incore flux monitor penetrations, and for concluding that the scope of either the BWRVIP-27 or BWRVIP-49 recommendations are applicable to the materials of fabrication, design aspects, and fabrication processes used in the fabrication of these additional penetrations.

In the response to RAI B.2.8-1, dated August 27, 2008, the applicant stated:

> The basis for extending the scope of GALL AMP XI.M8 to the RV drain penetrations, CRD penetrations, and incore flux monitor penetrations is that GALL Chapter IV, item IV.A1-5 recommends crediting the BWR Penetrations Program and the BWR Water Chemistry Program to manage cracking for these components. In addition to the RV drain penetrations, CRD penetrations, and incore flux monitor penetrations, which are named in GALL Item IV.A1-5, PPL extended this program to the RV flange leak off penetrations. While these penetrations are not named in GALL Item IV.AI-5, the BWR Penetrations Program, as specifically defined for SSES in the program basis document, is an appropriate program to credit for managing cracking for these penetrations.
>
> The BWR Penetrations Program comparison to GALL, as stated in the program basis document, includes the details for aging management for all penetrations within the scope of the program. The program will inspect all in-scope penetrations in accordance with the requirements of ASME Section XI,

augmented by the recommendations of approved BWRVIP reports. Inspections are scheduled in accordance with ASME Section XI, and examination results are evaluated in accordance ASME Section XI, IWB-3000. Acceptance of components for continued service is in accordance with ASME Section XI and, when applicable, BWRVIP guidance.

The SSES BWR Penetrations Program manages the CRD and flux monitor penetrations in accordance with the NRC-approved guidance in BWRVIP-47-A and BWRVIP-74-A. The RV flange leak off penetrations and the RV drain penetrations are being managed by NRC-approved guidance in BWRVIP-74-A. Thus, all penetrations are being managed by BWRVIP guidance that the NRC has previously approved as adequate for the period of extended operation.

The staff reviewed the GALL Report, item IV.A1-5 and notes that it does include CRD stub tubes, instrumentation, incore flux monitors and vessel drain line, and the recommended AMP to manage the aging effects is GALL AMP XI.M8. The staff also reviewed BWRVIP-47-A, and BWRVIP-74-A and concludes that these documents address CRD and flux monitor penetrations and are applicable.

Based on the review, the staff finds the applicant's response to RAI B.2.8-1 acceptable because the applicant has appropriately provided the basis for extending the scope of the GALL AMP XI.M8 to the RV flange leakoff line penetrations, RV drain penetrations, CRD penetrations, and incore flux monitor penetrations. Therefore, the staff's concern described in RAI B.2.8-1 is resolved.

Review of License Renewal Applicant Action Items. In the SEs on Topical Report BWRVIP-27, BWRVIP-47, BWRVIP-49, and BWRVIP-74 the staff issued the following renewal applicant action items common to the staff's evaluations on the reports:

1. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within this BWRVIP report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).

The applicant provided both the staff's renewal applicant action item descriptions and its responses to these actions items in LRA Appendix C, Tables BWRVIP-27-A, BWRVIP-47-A, BWRVIP-49-A and BWRVIP-74-A. The applicant stated that the BWRVIP program administratively requires (a licensee imposed requirement) the applicant to implement the applicable BWRVIP inspection and flaw evaluation guidelines (including those in BWRVIP-27, BWRVIP-47, BWRVIP-49, and BWRVIP-74) at SSES and that procedures administratively mandate the applicant to write a justification for any deviations from the recommended criteria in the applicable BWRVIP inspection and flaw evaluation guidelines. The applicant also stated it has not yet identified any deviations from its implementation of the BWRVIP-27, BWRVIP-47, BWRVIP-49, and BWRVIP-74 inspection and flaw evaluation guidelines, and commits to further implementation of the staff-approved versions of the BWRVIP-27, BWRVIP-47, BWRVIP-49, and BWRVIP-74 guidelines, in order to ensure that the aging effects applicable to the SLC/core

plate ΔP nozzles, RV instrumentation nozzles and other RV nozzles within the scope of the program will be managed, for the period of extended operation.

The staff confirms that the applicant has provided a commitment (Commitment No. 8) for continued implementation of the recommended inspection and flaw evaluation guideline recommendations, and that the commitment has been placed on UFSAR Supplement Section A.1.2.7. The staff finds that the applicant has adequately addressed the staff's renewal applicant action item on BWRVIP-27, BWRVIP-47, BWRVIP-49, and BWRVIP-74 because it clarified that SSES would not deviate from the recommended inspection and flaw evaluation criteria, and because the applicant has committed to continued implementation of the guidelines in these reports.

Based on this review, the staff concludes that the applicant has adequately addressed the staff's first renewal applicant action item on BWRVIP-27, BWRVIP-47, BWRVIP-49, and BWRVIP-74. Therefore, this renewal applicant action item is resolved.

2. Those applicants for license renewal referencing the BWRVIP-27 report for the DP/SLC vessel penetration/nozzle and safe end extensions shall ensure that the programs and activities specified as necessary in the BWRVIP-27 document are summarily described in the UFSAR supplement. Those applicants for license renewal referencing the BWRVIP-49 report for the instrument penetrations shall insure that the programs and activities specified as necessary in the BWRVIP-49 report are summarily described in the UFSAR supplement. Those applicants for license renewal referencing the BWRVIP-47 report for the lower plenum shall insure that the programs and activities specified as necessary in the BWRVIP-47 report are summarily described in the UFSAR supplement. Those applicants for license renewal referencing the BWRVIP-74 report for the RPV components shall ensure that the programs and activities specified as necessary in the BWRVIP-74 report are summarily described in the UFSAR supplement

The applicant stated that LRA Section A includes the UFSAR supplement for the BWR Penetrations Program. The staff confirmed that the applicant provides the UFSAR supplement summary description for the BWR Penetrations Program in UFSAR Supplement Section A.1.2.7. The staff also confirmed that LRA Section A.1.2.7 includes BWRVIP-27 and BWRVIP-49. However, in response to RAI B.2.8-1, dated August 27, 2008, the applicant added BWRVIP-47 and BWRVIP-74, which are not included in the UFSAR summary description. In a follow-up RAI B.2.8-1R, dated October 17, 2008, the staff requested that the applicant address this issue.

In the response to RAI B.2.8-1R, dated November 11, 2008, the applicant revised the LRA to include BWRVIP-47-A and BWRVIP-74-A in the descriptions of the BWR Penetrations Program in LRA Sections A.1.2.7 and B.2.8. The applicant revised the last sentences of A.1.2.7 and program description of B.2.7 as follows:

> BWRVIP-27-A report addresses the standby liquid control system nozzle or housing, the BWRVIP-47-A report addresses the control rod drive and flux monitor penetrations in the lower plenum, the BWRVIP-49-A report provides guidelines for instrument penetrations, and the BWRVIP-74-A report addresses the reactor vessel flange leakoff penetrations and the reactor vessel drain penetrations.

The staff reviewed the applicant response and notes that the applicant has appropriately identified BWRVIP-47-A and BWRVIP-74-A in the program description and in the UFSAR supplement. Based on this review, the staff finds the applicant response acceptable and concludes that the applicant has adequately addressed the staff's second renewal applicant action item on BWRVIP-27, BWR-47, BWRVIP-49 and BWRVIP-74. Therefore, this renewal applicant action item is resolved.

3. Those applicants for license renewal referencing BWRVIP-27 for the ΔP/SLC vessel penetration/nozzle and safe end extensions shall ensure that the inspection strategy described in the BWRVIP-27 report does not conflict or result in any changes to their technical specifications. Those applicants for license renewal referencing BWRVIP-49 for the instrument penetrations shall ensure that the inspection strategy described in the BWRVIP-49 document does not conflict or result in any changes to their technical specifications. Those applicants for license renewal referencing BWRVIP-47 for the lower plenum shall ensure that the inspection strategy described in the BWRVIP-47 document does not conflict or result in any changes to their technical specifications. Those applicants for license renewal referencing the BWRVIP-74 report for the RPV components shall ensure that the inspection strategy described in the BWRVIP-74 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal.

The applicant stated that its implementation of the inspection strategies in BWRVIP-27, BWRVIP-47 and BWRVIP-49 will not result in the need for any changes of the TS for either Unit 1 or Unit 2. The staff reviewed the TSs for Units 1 and 2 and confirmed that, while the methods in BWRVIP-27, BWRVIP-47, and BWRVIP-49 may constitute alternative staff-approved inspection guidelines for the ASME Code Class 1 RV penetration nozzle welds, the TSs for SSES do not include any requirements to implement the ASME Code Section XI ISI programs, neither do they include BWRVIP-27, BWRVIP-47 or BWRVIP-49 augmented inspection program criteria. The staff also confirmed that the applicant's TSs are derived from operational, surveillance, and administrative control-based requirements and that, instead, the ISI Program requirements and BWRVIP-27, BWRVIP-47, and BWRVIP-49 augmented inspection process are implemented through the applicant's ASME Code Section XI ISI program, in accordance with 10 CFR 50.55a. Thus, based on this review, the staff concludes that the applicant has provided an adequate basis for concluding that its implementation of the guidelines in BWRVIP-27, BWRVIP-47, and BWRVIP-49 will not conflict with or result in any necessary changes in the SSES TSs. Based on this review, the staff concludes that the applicant has adequately addressed the staff's third renewal applicant action item on BWRVIP-27, BWRVIP-47, and BWRVIP-49. Therefore, this renewal applicant action item is resolved.

In the SE for BWRVIP-27, the staff included an additional fourth license renewal applicant action item. In this action item, the staff stated that BWR applicants referencing the BWRVIP-27 report should identify and evaluate the projected fatigue cumulative usage factors (CUFs) for their SLC/core plate ΔP nozzles as a potential TLAA for the application. The applicant stated that the only analysis on the SLC/core plate ΔP nozzles that meets the definition of a TLAA is the CUF analysis for the SLC/core plate ΔP nozzles and that the TLAA analysis for these nozzle components is provided in LRA Section 4.3.1. The staff confirmed that the applicant has included its metal fatigue CUF analysis for the N-10 SLC/core plate ΔP nozzles in LRA Section 4.3.1 and that LRA Table 4.3-2 includes both the design basis CUFs and the 60-year projected CUFs for N-10 SLC/core plate ΔP nozzles. Based on this review, the staff finds that

the applicant has met this renewal applicant action item because, consistent with the action item, the applicant has identified the CUF analysis for these nozzles as a TLAA, and has provided this TLAA in LRA Section 4.3.1. The staff evaluates this TLAA in SER Section 4.3.1. Therefore, this renewal applicant action item is resolved.

Based on the review of the exception, and resolution of the related RAI, the staff finds the BWR Penetrations Program consistent with the program elements of GALL AMP XI.M8, with an exception and therefore is acceptable.

Operating Experience. The staff reviewed the applicant's "operating experience" program element discussions in the BWR Penetrations Program and in the license renewal basis document for this AMP. The staff noted that the "operating experience" program element in the license renewal basis document indicated that the applicant had reviewed the last five Inservice Inspection Outage Summary Reports for Units 1 and 2 and that the ISIs or augmented ISIs performed on the penetration nozzles did not identify any relevant flaw indications. The staff confirmed that, although the applicant has not yet identified any relevant indications for the penetrations within the scope of this AMP, it has recorded flaw indications and initiated appropriate CR action requests on flaw indications identified in some of the RV internal components. These actions are part of the applicant's in-vessel visual inspections performed on its BWR RV internals, and which is another BWRVIP Report-based AMP.

The staff finds the applicant's "operating experience" program element acceptable because the applicant's augmented inspection process used to implement the BWRVIP-based augmented inspections of the RV penetration nozzles and RV internals components has actual detected and recordable RV internals indications that are within the scope of the BWR Vessel Internals Program. This demonstrates that the applicant's BWRVIP-based augmented inspection process for its RV penetration nozzles and RV internal components is effective. The staff also finds the OE acceptable because the applicant has committed (Commitment No. 8) to continued implementation of the BWR Penetration Program and; implementation of the guidelines in BWRVIP-27 for SLC/core plate ΔP nozzles, the BWRVIP-47 for CRD and flux monitor penetrations in the lower plenum, the BWRVIP-49 for RV instrument penetration nozzles, and the BWRVIP-74 for RV flange leakoff penetrations and the RV drain penetrations.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. The applicant provided the UFSAR supplement summary for the BWR Penetrations Program in LRA Section A.1.2.7 and Commitment No. 8 in Table A-1. The staff reviewed this section and notes that in response to RAI B.2-1R, dated November 11, 2008, the applicant revised the UFSAR supplement to add BWRVIP-49 and BWRVIP-74. The staff confirms that that applicant has committed (Commitment No. 8) to continue implementation of the recommended inspection and flaw evaluation guidelines. The staff finds that the applicant's UFSAR supplement summary description for the BWR Penetrations Program, with this revision, conforms to the staff's recommended UFSAR supplement in SRP-LR Table 3.1-2.

Based on this review, the staff finds that UFSAR Supplement Section A.1.2.7, when coupled with Commitment No. 8, provides an acceptable UFSAR supplement summary description of the applicant's BWR Penetrations Program because it is consistent with the UFSAR supplement summary description in the SRP-LR.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's BWR Penetrations Program and the applicant's response to the staff RAIs, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d) and therefore is acceptable.

3.0.3.2.4 BWR Vessel Internals Program

Summary of Technical Information in the Application. In LRA Section B.2.9, the applicant described the existing BWR Vessel Internals Program as consistent, with an enhancement, with the GALL AMP XI.M9, "BWR Vessel Internals." The applicant stated that this program is used to manage cracking, loss of material, and reduction of fracture toughness for various subcomponents of the RV internals.

Staff Evaluation. During the audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine whether the AMP, with the enhancement, is adequate to manage the aging effects for which the LRA credits it. The staff noted that the program elements in the applicant's AMP claim of consistency with the GALL Report were consistent with the GALL AMP XI.M9, with the exception of the issue identified below that the staff determined required additional clarification. The staff also confirmed that the plant program contains all of the elements of the referenced the GALL Report. The staff conducted onsite interviews with the applicant to confirm these results.

The staff noted that the scope of the BWR Vessel Internals Program includes Topical Report BWRVIP-76, which has been approved by the staff and which provides the BWRVIP's recommended inspection and flaw evaluation guidelines for BWR core shrouds. BWRVIP-76, Appendix C (a) provides guidance to evaluate structural integrity of the core shroud welds exposed to neutron radiation during plant operation, (b) discusses the use of generic fracture mechanics analyses for establishing inspection intervals for core shroud welds containing cracks, and (c) provides the notch fracture toughness values for irradiated stainless steel materials. The data in this appendix suggest that the fracture toughness values for stainless steel materials tends to decrease with increasing exposure to neutron fluences greater than 1E21 n/cm^2 (E> 1 MeV). In August 2006, the BWRVIP issued staff-approved Topical Report No. BWRVIP-100-A, "Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds," which discussed and provided updated fracture toughness results for irradiated stainless steel materials. The BWRVIP-100-A report identified that the fracture toughness values for irradiated stainless steel material may actually be lower than those previously documented in the staff-approved version of BWRVIP-76.

In RAI B.2.9-3, dated July 23, 2008, the staff requested that the applicant clarify whether the results and recommendations in the staff-approved BWRVIP-100-A are within the scope of the BWR Vessel Internals Program and; if yes, clarify how the recommendations in BWRVIP-100-A

will be used in conjunction with the recommendations in BWRVIP-76 for evaluations of cracking in core shrouds.

In the response to RAI B.2.9-3, dated August 27, 2008, the applicant stated that LRA Sections A.1.2.10 and B.2.9 state that the BWR Vessel Internals Program includes inspection and flaw evaluation that conforms to the guidelines of applicable and staff-approved BWRVIP reports. As such, BWRVIP-100-A is currently within the scope of the BWR Vessel Internals Program. Under this AMP, the applicant is committed to following the current, staff-approved BWRVIP guidance for managing cracking of the core shroud, during the period of extended operation.

The applicant also stated that the current, staff-approved BWRVIP guidance for evaluating flaws in the high-fluence core shroud welds is documented in BWRVIP-76, BWRVIP-99, and BWRVIP-100-A and requires the use of the updated fracture toughness results for irradiated stainless steel materials from BWRVIP-100-A. The applicant further stated that until BWRVIP-76 Appendix C is revised as recommended in BWRVIP-100-A, only those shroud welds that have fluences less than 1E21 n/cm^2 will have their inspection intervals determined using BWRVIP- 76, Table 2-1. For shroud welds that have fluences greater than 1E21 n/cm^2, the inspection intervals will be determined on a case specific basis, in accordance with the guidance provided in BWRVIP-99 and BWRVIP-100-A.

Based on the review, the staff finds the applicant's response to RAI B.2.9-3 acceptable because the applicant has adequately clarified its use of the latest staff approved BWRVIP-100A for core shroud welds that have fluences greater than 1E21 n/cm^2 and BWRVIP-76 for core shroud welds that have fluences less than 1E21 n/cm^2. The staff determines that the applicant has satisfactorily described how it proposes to use BWRVIP-76 and BWRVIP-100-A in conjunction with each other and has committed to follow the current staff-approved BWRVIP guidance to manage cracking of core shroud welds. Therefore, the staff's concern described in RAI B.2.9-3 is resolved.

Separately, during the TLAA review, the staff found that irradiation assisted stress corrosion cracking (IASCC) was not discussed in LRA Section 4.0, but was mentioned in LRA Appendix C regarding SSES's responses to BWRVIP report application action items. Therefore, RAI 4.7.3-2 was issued to request SSES (1) to address IASCC in austenitic stainless steel RPV internals in the TLAA section to build the connection between LRA Section 4.0 and LRA Appendix C, and (2) to make a commitment to address all BWRVIP-76 (LR) requirements and conditions as modified by the NRC SER on this report, to be issued after the NRC review of BWRVIP-76 (LR) is completed.

Regarding Item (1) of RAI 4.7.3-2, the staff found out later that the issue has been addressed thoroughly in Section 3.0.3.2.4. Therefore, there is no longer a need to address IASCC in Section 4.0. Regarding Item (2) of RAI 4.7.3-2, the applicant stated that in addition to the actions implemented under LRA AMP B.2.9, specific requirements imposed for certain components for license renewal were addressed in LRA Appendix C. Further, a new commitment (Commitment No. 56) was added to LRA Table A-1 to address any future conditions, requirements, or limitations imposed by the NRC's SER for BWRVIP-76 (LR). Hence, RAI 4.7.3-2 is resolved.

In the review of the program basis document, the staff determined that the applicant is crediting the BWR Vessel Internals Program to manage the aging effects of reduction in fracture toughness for core shroud, core plate, top-guide components, orificed and peripheral fuel

support pieces, CRD tubes, jet pump assemblies and their subcomponents, and incore dry tubes from the source range and intermediate range monitors. The staff has confirmed that the program credits the augmented inspection and flaw evaluation criteria in staff-approved BWRVIP topical reports as the basis for managing the aging effects applicable to SSES RV and RV internal components. Loss (reduction) of fracture toughness is not an aging effect "per se," but, instead, refers to a change that may occur in the fracture toughness material property over time.

In RAI B.2.9-4, dated July 23, 2008, the staff requested that the applicant explain how the recommended BWRVIP report guidelines within the scope of the BWR Vessel Internals Program BWRVIP, will accomplish adequate management of reduction of fracture toughness in these RV internal components. The staff also requested that the applicant justify why the applicable BWRVIP inspection and flaw evaluation guidelines for these RV internal components are considered to be capable of managing reduction of fracture toughness in the components, and clarify the methodology or methodologies in these reports credited for management of this aging effect.

In the response to RAI B.2.9-4, dated August 27, 2008, the applicant stated that the orificed fuel support pieces are CASS, and reduction of fracture toughness is managed by the Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS) Program, and not by the BWR Vessel Internals Program, as shown in LRA Table 3.1.2-2.

The applicant further stated:

> The remaining reactor vessel (RV) internals components are the core shroud, core plate, top guide, fuel support pieces (peripheral), control rod guide tubes, jet pump assemblies, and incore dry tubes. These components are all addressed in specific BWRVIP reports. The applicable BWRVIP inspection and flaw evaluation guidelines for these RV internal components are considered to be capable of managing ROFT because the inspections are designed to detect cracking, and, if cracking is detected, the inspection intervals will be adjusted based on crack growth rates that are determined by evaluations that include the effects of ROFT. The examination methods in the BWRVIP reports include ultrasonic examination and visual examination of the RV internal components, when accessible, for the detection of cracks. These same methods are credited for managing ROFT, since ROFT is managed as cracking is identified, evaluated, and monitored in components with fluence values exceeding the threshold for ROFT.

Based on the review, the staff finds the applicant's response to RAI B.2.9-4 acceptable because the applicant has adequately explained that the BWRVIP guidelines provide examination methods and evaluation techniques to detect cracking, and inspection intervals are adjusted based on the results of the inspection. The staff finds that the guidelines will also manage reduction of fracture toughness, since fluence is one of the key factors affecting the crack growth rate, which increases as fluence increases the yield strength of the material (i.e., reduces fracture toughness). Therefore, the staff's concern described in RAI B.2.9-4 is resolved.

The staff noted that BWRVIP-76, Appendix C provides guidance to evaluate structural integrity of the core shroud welds which is affected by the exposure to neutron radiation during the

service. In this appendix, the BWRVIP discusses the use of generic fracture mechanics analyses for establishing inspection intervals for the core shroud welds with cracks, and previous data suggests that the fracture toughness values tend to decrease when stainless steel materials are exposed to neutron fluence. BWRVIP-76, Appendix C provides notch toughness values which can be used for irradiated stainless steel materials.

In RAI B.2.9-5, dated July 23, 2008, the staff requested that the applicant clarify whether the results and recommendations in the staff-approved BWRVIP-100-A are within the scope of the BWR Vessel Internals Program and; if yes, clarify how the recommendations in BWRVIP-100-A will be used in conjunction with the recommendations in BWRVIP-76 for evaluations of cracking in core shrouds.

In the response to RAI B.2.9-5, dated August 27, 2008, the applicant stated that its response to RAI B.2.9-3, above, addresses RAI B.2.9-5. The staff acknowledges that RAI B.2.9-3 requested the same information as RAI B.2.9-5 and finds that the applicant's response to RAI B.2.9-3 also is acceptable for RAI B.2.9-5. Therefore, the staff's concern described in RAI B.2.9-5 is resolved.

Enhancement 1. The staff noted that the applicant's program indicated that the "scope of program" program element for the BWR Vessel Internals Program will be enhanced to require augmented inspection of the SSES top guide grid beams and beam-to-beam crevice slots. The augmented inspections of these components will include completion of five percent of the total population of grid beams and beam-to-beam crevice slots within six years of entering the period of extended operation, with completion of an additional five percent within 12 years of entering the period of extended operation. The applicant stated that the scope of inspections will focus on those grid beams and beam-to-beam crevice slots with neutron fluences projected to be greater than 5.0×10^{20} n/cm^2 (E > 1.0 MeV) at 60 years.

The staff noted that GALL AMP XI.M9 indicates that the industry's augmented inspection and flaw evaluation guidelines for BWR top guides and their subcomponents are provided in Topical Report No. BWRVIP-26. The staff issued its SE on BWRVIP-26 in a letter to the BWRVIP owners group dated December 7, 2000. In this letter, the staff endorsed the BWRVIP owners group's recommended augmented inspection for BWR top guides and their subcomponents. However, these augmented inspection guidelines did not provide any recommendations for BWR top guide grid beam locations and beam-to-beam crevice slots. In the staff's updated GALL Report guidance, as described in the GALL AMP XI.M9, the staff took the position that augmented inspections should be performed on the top guide grid beam and beam-to-beam crevice slots to address the potential for IASCC to occur in these top guide locations. Specifically, the staff makes the following recommendation in GALL AMP XI.M9:

> Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5% of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5% of the top guide locations will be inspected within twelve years after the date projected for exceeding the threshold.

The staff's recommendation in the GALL AMP XI.M9 is predicated on the fact that an applicant for license renewal of its BWR facility has not yet detected any signs of cracking in the top guide grid beams and beam-to-beam crevice locations. The staff noted that the applicant's proposed enhancement calling for augmented inspections of the SSES top

guide grid beam and beam-to beam locations conforms to the recommendations in GALL AMP XI.M9, as long as there has not been any evidence of cracking in these top guide locations.

In RAI B.2.9-1, dated June 12, 2008, the staff requested that the applicant clarify whether it had performed any augmented inspections of the top guide grid beam and beam-to-beam crevice slot locations to date and; if so, summarize the inspection results of the augmented examinations performed on these top guide components.

In its response to RAI B.2.9-1, dated July 14, 2008, the applicant stated:

> The Unit 1 top guide beam and beam-to-beam crevice slot locations were inspected in 2004 during the thirteenth refueling outage. Twelve fuel cell locations were examined using the VT-3 inspection method. The Unit 1 top guide was inspected again in 2008. At that time, the top guide beam and beam-to-beam crevice slots at one cell location were inspected using the EVT- 1 inspection method. No recordable indications were found in either Unit 1 inspection.
>
> The Unit 2 top guide beam and beam-to-beam crevice slot locations at twenty-one fuel cell locations were inspected in the Unit 2 eleventh refueling outage in 2003 using the VT-3 inspection method. In 2007, four additional fuel cell locations in the Unit 2 vessel were inspected using the VT-3 inspection method. No recordable indications were found in either Unit 2 inspection.

Based on the review, the staff finds the applicant's response to RAI B.2.9-1 acceptable because the applicant has clarified that it has performed augmented inspections of the top guide grid beam and beam-to-beam crevice slot locations and no recordable indications were found. Therefore, the staff's concern described in RAI B.2.9-1 is resolved.

On the basis that the applicant has performed inspections of the top guide locations using appropriate inspection techniques, and no recordable indications were found, the staff finds the enhancement acceptable, because the implementation of the enhancement will make the applicant's program consistent with the GALL AMP XI.M9. The staff verified that the applicant has incorporated its enhancement of the BWR Vessel Internals Program in Commitment No. 9 in LRA Table A-1 and was placed on UFSAR Supplement Section A.1.2.10.

However, in response to RAI 4.3-4, dated November 25, 2008, the applicant stated that since the submittal of the LRA, the BWR Vessel Internals Program has been revised to include requirements to inspect the top guide. The applicant further stated that the BWR Vessel Internals Program now requires that at least 10 percent of the grid beam cells containing control rod drives and/or blades will be inspected every twelve years, with at least five percent of the inspections performed within the first six years of each twelve year interval. The applicant also stated that the top guide locations to be inspected are those subject to neutron fluence levels that exceed the IASCC threshold of 5.0E+20 n/cm^2, and that the inspections will be performed using the enhanced visual inspection technique, EVT-1.

Furthermore, in response to RAI 4.3-4, the applicant stated that PPL will continue to perform inspections on at least 10 percent of the top guide locations, every twelve years, during the period of extended operation. The applicant accordingly revised the LRA to delete the

enhancement from LRA Section B.2.9, UFSAR Supplement Section A.1.2.10, and LRA Table A-1 (Commitment No. 9).

In a teleconference held on December 18, 2008, the staff discussed with the applicant, the degree of detail needed for implementing augmented inspections of top guide grid-to-beam and beam-to-beam locations. In this teleconference, the staff established that the applicant would need to commit to augmented inspections of the top guide locations or amend its response to RAI 4.3-4. Any amended response to RAI 4.3-4 should discuss the corrective actions and sample expansion criteria that the applicant would implement, if augmented inspections of the top guide grid-to-beam and beam-to-beam locations detected cracking in the components.

In a letter dated December 29, 2008, the applicant submitted a supplemental response amending the LRA to include a commitment for augmented inspections of the top guide grid-to-beam and beam-to-beam locations, in UFSAR Supplement A.1.2.10. Specifically, the applicant committed to the following activities for the top guide grid-to-beam and beam-to-beam locations:

> PPL will continue to perform inspections on at least 10% of the top guide grid beam cells containing control rod drives/blades every twelve years during the period of extended operation, with at least 5% of the inspections being performed within the first six years of each twelve year interval. The top guide locations to be inspected are those subject to neutron fluence levels that exceed the IASCC threshold of 5.0E+20 n/cm^2. The inspections will be performed using the enhanced visual inspection technique, EVT-1.

The staff finds that the applicant's amendment for augmented inspection of the top guide grid-to-beam and beam-to-beam locations acceptable because the applicant's Commitment No. 9 for augmented inspection of these top guide locations is consistent with the staff's recommended augmented inspection criteria for the locations in the "detection of aging effects" program element in GALL AMP XI.M9.

Review of License Renewal Applicant Action Items. LRA Appendix C provides the applicant's responses to the staff's renewal applicant action items on the BWRVIP-based reports within the scope of the BWR Vessel Internals Program. The applicant's program also includes an enhancement to perform augmented inspections of the SSES top guide grid beam and beam-to-beam crevice slots. The staff evaluates the applicant's responses to the staff's renewal applicant action items later in this section.

The staff's license renewal applicant action items for the BWRVIP Topical Reports within the scope of a BWR Vessel Internals Program are provided in specific staff SEs issued to the BWRVIP with respect to their inspection and flaw evaluation guidelines.

The following table summarizes the topical reports within the scope of the applicant's BWR Vessel Internals Program and the staff's SEs issued on these topical reports.

Component	BWRVIP Topical Report Reference	NRC SER Date	SER Accession Number
RV Components	BWRVIP-74-A	10/18/01	ML012920549
Core Shroud Support and Attachments	BWRVIP-38	03/01/01	ML010600211

Core Shroud	BWRVIP-76		
Core Support Plate	BWRVIP-25	12/07/00	ML003775989
Core Spray Lines and Spargers	BWRVIP-18	12/07/00	ML003775973
Top Guide	BWRVIP-26	12/07/00	ML003776110
Jet Pump Assemblies	BWRVIP-41	05/01/01	ML011310322
RV Lower Plenum Components	BWRVIP-47	12/07/00	ML003775765

The staff confirmed that the applicant has responded to the staff's renewal applicant actions items on these BWRVIP reports in LRA Appendix C. The staff noted that the staff's first three renewal applicant action items all dealt with: (a) identifying any deviations not conforming to the BWRVIP's recommended guidelines in these topical reports, (b) identifying any TSs that may require license amendments as a result implementing the BWRVIP guideline recommendations, pursuant to 10 CFR 50.90, and (c) ensuring the UFSAR supplement for the BWR Vessel Internals Program had incorporated an appropriate UFSAR supplement summary description for the BWRVIP recommended activities.

The staff evaluated the applicant's responses to the first three renewal applicant action items. With respect to the applicant's responses, the staff finds that the applicant had, in all cases, properly identified the renewal applicant action items and provided an acceptable basis for responding to and resolving them.

Beyond the first three renewal applicant action items, the staff finds that the applicant had in all cases properly identified the renewal applicant action items and provided an acceptable basis for responding to and resolving them, with the following exceptions:

In renewal applicant action item No. 5 on BWRVIP-25, the staff stated that "until such time as an expanded technical basis for not inspecting the rim hold-down bolts is approved by the staff, applicants referencing the BWRVIP-25 report for license renewal should continue to perform inspections of the rim hold-down bolts."

In response to renewal applicant action item No. 5 on BWRVIP-25, the applicant stated that the re-inspection strategy for SSES currently does not include any further bolt inspections. The applicant stated that this strategy is justified by the results of the baseline inspections, which found no crack indications, and a plant-specific analysis, which determined that adequate bolt preload will be retained after 60 years of operation, even if the bolts contain cracks. The applicant further stated that prior to entering the period of extended operation, PPL will either (a) request staff approval of the justification for not inspecting the core plate hold-down bolts, (b) implement a revised inspection strategy, approved by the staff, to ensure an adequate number of bolts are intact, and to prevent lateral displacement of the core plate, or (c) install core plate wedges to structurally replace lateral load resistance provided by the bolts.

The staff determines that the applicant has not included this re-inspection strategy commitment in the LRA Table A-1. However, in response to RAI 4.7.3-1, dated October 18, 2007, the applicant committed (Commitment No. 55) to either obtain staff approval for plant-specific analyses to justify not inspecting the bolts or to install core plate wedges.

On this basis, the staff finds that the applicant has properly addressed renewal applicant action item No. 5 on BWRVIP-25 and provided an acceptable basis for responding to and resolving it.

In renewal applicant action item No. 4 for BWRVIP-26, the staff stated that "Due to IASCC susceptibility of the subject safety-related components, applicants referencing the BWRVIP-26 report for license renewal should identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue."

In response to renewal applicant action item No. 4 for BWRVIP-26, the applicant stated that "accumulated neutron fluence for the top guide is not a TLAA for SSES. The top guide will exceed the threshold fluence levels for IASCC identified in BWRVIP-26-A. The aging effect is managed per the inspection recommendations in BWRVIP- 26-A. This strategy for managing IASCC in the top guide addresses the issue raised in renewal applicant action item No. 4 on BWRVIP-26 and will ensure that the proposed inspections will monitor for cracking in those top guide locations that have the highest probability of initiating IASCC."

The neutron fluence methodology for the RVs and RV internal components has been approved by the staff and is assessed in SER Section 4.2.1. Based on this assessment, the staff concludes that the applicant has taken a conservative approach to managing IASCC of the top guides and further concludes that the applicant's aging management strategy is an acceptable alternative to providing a beyond-CLB TLAA, as otherwise might have been done to satisfy renewal applicant action item No. 4 on BWRVIP-26. Therefore, renewal applicant action item No. 4 on BWRVIP-26 is considered resolved.

Operating Experience. The staff reviewed the applicant's "operating experience" program element discussions in the BWR Vessels Internals Program and in the license renewal basis document for this AMP. The staff noted that the applicant has not identified any relevant SSES-specific or generic OE in the "operating experience" program element discussion for the BWR Vessels Internals Program. The staff also noted that the license renewal program documents for this AMP does include several CRs/Action Requests that reported the occurrence of flaw indications (cracks) in the core spray sparger brackets, core shroud circumferential welds and some of jet pump assembly components (i.e., jet pump restrainers, wedges, and rods). The staff also observed that the applicant has dispositioned these flaw indications as acceptable (i.e., "as-is") for further service without the need for repair or replacement of the components at this time.

In RAI B.2.9-2, dated June 12, 2008, the staff requested that the applicant justify why the flaw indications in the core spray sparger brackets, core shroud welds, and jet pump assembly components have not been identified as relevant OE for the BWR Vessels Internals Program, and explain its basis for leaving the flaws in these components in service (i.e., acceptable "as-is") without repair or replacement of the impacted components. The staff also requested that the applicant state, with a technical justification, what the inspection frequencies and sample sizes will be for re-inspecting these RV internal components, during the period of extended operation.

In the response to RAI B.2.9-2, dated July 14, 2008, the applicant stated that PPL has identified flaw indications in the core spray sparger brackets, core shroud welds, and jet pump assembly components. The applicant also stated that all identified flaws allowed to remain in-service (i.e., acceptable "as-is") have been evaluated in accordance with the applicable BWRVIP documents.

The applicant amended the LRA to add the relevant information to the "operating experience" program element of LRA Section B.2.9 as follows:

> For core shroud horizontal welds, initial indications were found in Units 1 and 2 in 1995. Subsequent inspections were performed in each outage since 1995. Most of the horizontal welds in both units exhibited some degree of cracking. To date, the flaws detected have been evaluated using the methods and criteria defined in BWRVIP-76, and found structurally adequate until the next inspection. Future inspections are scheduled for 2009 for Unit 2 and 2010 for Unit 1. Results of the inspection and evaluation determine the frequency of the next inspection.
>
> For core spray sparger brackets, a flaw was first identified in Unit 1 in 1996 and in Unit 2 in 1997. These flaws were reexamined in 2004 and 2005, and three more flaws were identified in the shroud plate base metal area. These flaws were evaluated using the guidance and criteria of BWRVIP-76 and found to have adequate structural margin. The core spray sparger brackets are currently inspected in every outage. The recent inspections of the flaws that were identified in 2004 and 2005 did not find any further growth in the flaws.
>
> The jet pump holddown beams on all Unit 1 and Unit 2 jet pumps were replaced in 1993 and 1994, respectively, in response to industry experience. In 2001, excessive jet pump wedge wear and set screw gaps were observed on the Unit 2 jet pumps. Similar observations were made in 2002 on Unit 1. In 2003 (for Unit 2) and 2004 (for Unit 1), modifications were installed, including machining labyrinth seals in 20 jet pump inlet mixers (to reduce flow induced vibration), replacing several wedges, and machining several restrainer bracket pads. Subsequent inspections have revealed additional minor wedge and rod wear. These components will continue to be monitored in accordance with BWRVIP-41, and repairs or modifications made as required to ensure the jet pumps are properly supported.

Based on the review, the staff finds the applicant's response to RAI B.2.9-2 acceptable because the applicant has provided plant-specific operating experience relative to the BWR Vessel Internals Program. The staff determines that the applicant will perform inspections on these components at every outage, and the results will be evaluated using the guidance and criteria provided in staff-approved BWRVIP documents that determine the next set of inspections. Therefore, the staff's concern described in RAI B.2.9-2 is resolved.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. The applicant provided its UFSAR supplement summary for its BWR Vessel Internals Program in LRA Section A.1.2.10 and Commitment No. 9 in Table A-1. The staff confirms that the UFSAR supplement summary description for the BWR Vessel Internals Program conforms to the staff's recommended UFSAR supplement described in SRP-LR Table 3.1-2. The staff also confirms that by letter dated December 29, 2008, the applicant has committed (Commitment No. 9) to the enhancement of the program to implement augmented inspections of the SSES top guide grid beam and beam-to-beam crevice slot locations, during the period of extended operation. The staff finds the applicant's commitment for the augmented inspections of the top guide grid beam and beam-to-beam locations are acceptable because

they conform to the staff's recommended augmented inspection criteria in the "detection of aging effects" program element in GALL AMP XI.M9.

Based on this review, the staff finds that UFSAR Supplement Section A.1.2.10, when coupled with the letter dated December 29, 2008, provides an acceptable UFSAR supplement summary description of the applicant's BWR Vessel Internals Program because it is consistent with the SRP-LR and because the UFSAR supplement includes Commitment No. 9 on augmented inspection bases for top guide grid beam and beam-to-beam locations.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's BWR Vessel Internals Program and the applicant's response to the staff's RAIs, including deletion of the enhancement, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d) and therefore is acceptable.

3.0.3.2.5 Bolting Integrity Program

Summary of Technical Information in the Application. The LRA Section B.2.12 describes the existing Bolting Integrity Program as consistent, with five exceptions and one enhancement, with GALL AMP XI.M18, "Bolting Integrity." The Bolting Integrity Program includes, through other credited programs, the periodic inspection of bolting for indication of degradation such as leakage, loss of material, or cracking.

Prior to the period of extended operation, the Bolting Integrity Program will include a specific precaution against the use of sulfur (sulfide) containing compounds as a lubricant for bolted connections.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. During its on-site review, the staff reviewed the applicant's on-site documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL report. The staff also interviewed the applicant's technical staff.

The staff reviewed the enhancement and exceptions to determine whether the AMP, is adequate to manage the aging effects for which the LRA credits it.

In the LRA, the applicant stated that the AMP B.2.12 is an existing program that is consistent with GALL AMP XI.M18, "Bolting Integrity" with exceptions and an enhancement. The exceptions affect the scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria GALL Report program elements. The enhancement affects the preventive actions program element, and includes a precaution against using compounds containing sulfur as a lubricant for bolting.

During its on-site review, the staff reviewed the applicant's on-site documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the

GALL report. The staff interviewed the applicant's technical staff and reviewed on-site documents.

In comparing the program elements in the applicant's program to those in GALL AMP XI.M18, the staff found that the GALL Report "corrective actions" program element was not cited as including an exception even though the bolting integrity program does not explicitly address the guidelines outlined in EPRI NP-5769 as recommended by the GALL Report. By letter dated June 30, 2008, the staff issued RAI B.2.12-2 requesting the applicant provide more information on the basis for this exception.

By letter dated July 28, 2008, the applicant responded to RAI B.2.12-2 by stating that the AMP B.2.12 follows the guidelines and recommendations of EPRI NP-5067 and EPRI TR-104213, instead of EPRI NP-5769 and NUREG-1339, and revised its AMP B.2.12 description in the LRA to identify this as an exception to the corrective actions program element. Based on the amendments made to the LRA, the staff found the applicant's response to be acceptable.

Exception 1. LRA Section B.2.12 states an exception to the following GALL Report program elements: scope of program, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria. Specifically, the exception stated:

> The inspection of structural bolting (including component support bolting) for indication of potential problems is accomplished under the ISI Program – IWF and Structures Monitoring Program, consistent with the corresponding NUREG-1801 items.

The staff reviewed the scope of the Bolting Integrity Program in the GALL Report, and found that it primarily applies to the ASME code piping and components, including high strength bolting used in NSSS component supports where the actual yield strength is greater than 150 ksi. Other structural bolting used in supports, including expansion and anchor bolts are managed under ASME Code, Section XI, Subsection IWF (B.2.36) in accordance with GALL Report. The applicant stated that there is no high strength bolting where the actual yield strength is greater than 150 ksi. The staff finds that this 150 ksi limit is a specified value in the GALL Report wherein structural bolting with a yield strength below this value is not included in the scope of the AMP B.2.12. On the basis of its review as described above, the staff finds that this exception is acceptable.

Exception 2. LRA Section B.2.12 states an exception to the following GALL Report program elements: scope of program, and preventive actions. Specifically, the exception stated:

> The Bolting Integrity Program does not explicitly address the guidelines outlined in EPRI NP-5769 or as delineated in NUREG-1339. However, the Bolting Integrity Program does rely on the recommendations of the manufacturer/vendor and the industry, contained in EPRI documents NP-5067 and TR-104213, and will include a precaution against the use of any sulfur (sulfide) containing compound as a lubricant.

The staff reviewed the guidance documents, and determined that EPRI TR-104213 is a guidance document endorsed by the GALL AMP XI.M18, however the guidance document EPRI NP-5067 is not specifically endorsed. By letter dated June 30, 2008, the staff issued RAI B.2.12-3 requesting additional information from the applicant detailing the differences between the guidance documents.

By letter dated July 28, 2008, the applicant responded to RAI B.2.12-3 by stating that although the AMP B.2.12 follows the guidelines and recommendations of EPRI NP-5067 and EPRI TR-104213, instead of EPRI NP-5769 and NUREG-1339, the Bolting Integrity Program still meets the intent of the GALL Report recommendations. The applicant referenced a point-by-point comparison of the two sets of documents dated April 1, 2005 (ML051020128). This comparison was previously accepted by the NRC, and found to adequately address the bolting guidelines in the GALL Report. Based on the justification provided, the staff finds the applicant's response to be acceptable.

Exception 3. LRA Section B.2.12 states an exception to the GALL Report program element parameters monitored or inspected. Specifically, the exception stated:

> Loss of preload/loss of pre-stress is not an aging effect requiring management for SSES bolting since SSES systems operate below the 700 °F threshold where stress relaxation becomes a plausible age-related concern. Improper bolting application or maintenance issues that might result in loss of preload are current plant operational (design) concerns, as supported by site operating experience, and are not related to aging.

The staff reviewed the GALL Report and SRP-LR on the management of loss of preload, and finds that the management of loss of preload is also addressed in the GALL Report program element, preventive actions. Proper maintenance practices requiring the application of an appropriate preload must exist. Additionally, the applicant states in its LRA that loss of preload is not an aging effect requiring management since it does not reach the 700 °F threshold at which loss of preload due to thermal effects aging mechanism occurs. However, loss of preload is identified in the GALL Report to include not only thermal effects, but also gasket creep and self loosening as other aging mechanisms. The aging mechanisms of gasket creep and self loosening are not properly discussed in this exception, and appears to imply that loss of preload due to gasket creep and/or self loosening are not accounted for by the applicant. Therefore, by letter dated September 23, 2008, the staff issued RAI B.2.12-5 requesting additional information from the applicant regarding the management of loss of preload.

By letter dated October, 22, 2008, the applicant responded to RAI B.2.12-5 by providing its technical basis for the exclusion of the loss of preload aging effect by addressing the three aging mechanisms which could lead to loss of preload- thermal effects, gasket creep, and self loosening. The applicant referenced EPRI document 1010639 which states that "Loss of preload is not an applicable aging effect." This document is not endorsed by the GALL AMP XI.M18, and contradicts the GALL Report, which specifically identifies loss of preload as an aging effect with these three aging mechanisms. The staff recognizes that the conditions which lead to loss of preload by thermal effects may not exist at SSES, and also that indications for loss of preload are being monitored while monitoring for leakage, loss of material, and cracking. However, the guidance from the GALL AMP XI.M18 and EPRI NP-5067, which the applicant follows, indicates that loss of preload due to thermal effects, gasket creep, and self loosening is in fact an aging effect requiring management. The staff finds that though it is possible to monitor for indications of loss of preload such as leakage, the loss of preload aging effect still must be an aging effect which is managed by the AMP B.2.12. However the applicant's response to part (c) of RAI B.2.12-5 appears to directly contradict this important distinction.

The staff discussed their concerns with the applicant in a teleconference on October 27, 2008. By letter dated November 4, 2008, the applicant supplemented its response to RAI B.2.12-5,

letter dated October, 22, 2008, by clarifying that although the loss of preload aging effect is not included in any of the AMR line items in the LRA, the AMP B.2.12 still "provides for the management of loss of preload for all in-scope, pressure-retaining bolted closures at SSES." With this distinction, the staff finds the applicant's response and exception to be acceptable.

Exception 4. LRA Section B.2.12 states an exception to the GALL Report program element monitoring and trending. Specifically, the exception stated:

> Periodic inspection of bolting, other than of the Class 1, 2 and 3 bolting performed by the ISI Program, is performed through the System Walkdown Program, including follow-up inspections if leakage is detected. The frequency of follow-up inspections is established by engineering evaluation of the identified problem. SSES operating experience has not shown a need for a set frequency (e.g., daily) applicable to all cases involving bolting.

The staff reviewed the GALL Report "monitoring and trending" program element and found that the recommendation for leak rate to be monitored on a particularly defined schedule was not clear in the applicant's bolting integrity program. Therefore, by letter dated June 30, 2008, the staff issued RAI B.2.12-1 requesting additional information on the applicant's leak rate monitoring schedule.

By letter dated July 28, 2008, the applicant stated that in cases of leakage on bolting connections for pressure retaining components (not covered by ASME Section XI), the inspection frequency is determined by engineering evaluation of the problem. The applicant stated that this is achieved at SSES through the plant minor deficiency monitoring program, which establishes the guidelines for identifying, monitoring, tracking, and disposition of minor deficiencies, such as leaks, that are discovered during walk downs. For any leak, an evaluation is completed to determine the actions required based on the severity of the leak and the potential to impact normal operations and safety. Furthermore, if the leak rate changes, further evaluation is performed to determine the actions required. Based on the justification provided, the staff found the applicant's response and exception to be acceptable.

Exception 5. LRA Section B.2.12 states an exception to the GALL Report program element acceptance criteria. Specifically, the exception stated:

> The program does not specify acceptance criteria for bolting. However, the ISI Program and the System Walkdown Program, through which the periodic visual inspection of mechanical components within the scope of license renewal are performed, do include acceptance criteria for evidence of degradation of components, including the bolting.

The staff finds that the applicant properly addresses the intent of the GALL Report program element acceptance criteria through the implementation of its corrective action program as well as through the acceptance criteria identified in the Inservice Inspection Program and System Walkdown Program. Therefore, the staff finds this exception to be acceptable.

Enhancement. LRA Section B.2.12 states an enhancement to the GALL Report program element preventive actions. Specifically, the enhancement stated:

> The program will include a specific precaution against the use of sulfur (sulfide) containing compounds, such as molybdenum disulfide (MoS2), as a lubricant for

threaded fasteners (bolting), to further preclude the potential for stress corrosion cracking.

The staff reviewed EPRI-5769, Volume 1, Section 11 and found that it specifically identifies lubricants containing molybdenum disulfides as a common factor in several SCC related failures. The applicant's enhancement directly addresses this issue, as it commits to include a specific precaution against the use of compounds containing sulfur (sulfide), including molybdenum disulfide (MoS_2), as a lubricant for bolting. When implemented prior to the period of extended operation, AMP B.2.12 will be consistent with the recommendations of GALL AMP XI.M18. On the basis of the guidance of the GALL Report, the staff finds this to be acceptable.

Operating Experience. The staff also reviewed the operating experience described in LRA Section B.2.12. The applicant stated that "No instances of cracking or age-related loss of preload have been identified for bolting/fasteners, though some corroded bolting or facing surfaces (e.g., from general corrosion or leakage) have been identified at SSES." To verify the accuracy of this statement, the staff reviewed a sample of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. A 2002 condition report described the degraded condition of a total of 26 corroded bolts on the A1 and A2 diesel generator intercoolers. Upon further questioning of the applicant's staff and review of the CR, the staff discovered that the applicant performed additional investigation and evaluation to determine the root cause of the corroded bolts to be moisture and warm conditions. As a result, all 26 bolts were replaced, and proper corrective actions were demonstrated. This report as well as other condition reports reviewed by the staff during the audit helped to confirm the applicant's statement above, and helped to demonstrate that proper corrective actions are taken to address bolting issues.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.2 and Commitment No. 12 in Table A-1, the applicant provided the UFSAR Supplement for the Bolting Integrity Program. The staff reviewed this section and finds it acceptable because it is consistent with the corresponding program description in SRP-LR Table 3.1-2.The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff verified that, Commitment No. 12 in the LRA Table A-1, includes a brief description of the enhancement and committed to enhancing the program to include specific precautions regarding the use of lubricants for threaded fasteners prior to the period of extended operation.

Conclusion. The staff has reviewed the information provided in Section B.2.12 of the LRA Appendix B and additional information provided by the applicant by letters dated July 28, 2008, October 22, 2008, and November 4, 2008. On the basis of its review as discussed above, the staff concludes that the applicant has demonstrated that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report.

In addition, the staff reviewed the exceptions and the associated justifications, and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the staff has reviewed the enhancement and confirmed that the implementation

of the enhancement prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Piping Corrosion Program

Summary of Technical Information in the Application. LRA Section B.2.13 describes the Piping Corrosion Program as an existing program that is consistent, with exceptions and enhancements, with GALL Report AMP XI.M20, "Open-Cycle Cooling Water System." The applicant stated that this program fully meets the intent of NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment." The applicant further stated that the program is a combination of condition monitoring program (consisting of inspections, surveillances, and testing to detect the presence of, and to assess the extent of, fouling and loss of material) and a mitigation program (consisting of chemical treatments and cleaning activities to minimize fouling and loss of material).

Staff Evaluation. During the audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the applicant's on-site documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL report. The staff also interviewed the applicant's technical staff.

In comparing the elements in the applicant's program to those in the GALL AMP XI.M20, the staff noted that the program elements in the applicant's AMP claimed to be consistent with the GALL were consistent with the corresponding program element criteria recommended in the program elements of GALL AMP XI.M20 with the exception of the "scope of program" program element aspect as identified below that the staff determined was in need of additional clarification. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report.

The staff reviewed the applicant's license renewal basis document and confirmed that the program scope includes the systems and components that could be affected by piping corrosion.

In LRA Table 3.2.2-7, Standby Gas Treatment System (SGTS), the Piping Corrosion Program is credited for managing the aging effect of loss of material for loop seal piping and valve bodies. However, a review of the license renewal basis document for the Piping Corrosion Program indicated that SGTS is not included in the scope of the Piping Corrosion Program. The staff issued RAI B.2.13-1 by letter dated May 30, 2008, requesting the applicant to justify why it is not included and to justify how the Piping Corrosion Program will manage the aging effects of these components in SGTS.

In the letter dated June 30, 2008, the applicant responded to RAI B.2.13-1 by amending the Piping Corrosion Program. This is discussed in the Enhancement 1 section.

The staff reviewed the exceptions and enhancements to determine whether the AMP, with the exceptions and enhancements is adequate to manage the aging effects for which the LRA credits it.

Exception 1. In LRA Section B.2.13, the applicant stated an exception to the "preventive actions" program element that system components are lined or coated only where necessary to protect the underlying metal surfaces. The GALL AMP XI.M20 recommends that system components are lined or coated.

The GALL Report Volume 2 Chapter VII for the Open-Cycle Cooling Water System includes piping, piping components and piping elements made of steel (with or without coatings), stainless steel and copper alloy materials. The GALL Report recognizes that steel components may be coated or uncoated. Based on this review, the staff finds the exception acceptable because the applicant is using materials that are appropriate for the system and has lined or coated steel where necessary to protect the underlying material.

Exception 2. In LRA Section B.2.13, the applicant stated an exception to the "monitoring and trending" program element that inspection frequencies are based on operating conditions and past history; flow rates, water quality, lay-up and heat exchanger design. The GALL AMP XI.M20 recommends testing and inspections be performed annually and during RFOs.

The staff issued RAI B.2.13-5 by letter dated May 30, 2008, to request the applicant to confirm if these frequencies are in accordance with the information provided in GL 89-13 concerning a routine inspection and maintenance program and Section D, "frequency of testing and maintenance," in GL 89-13, Supplement 1, and if not, to justify why the GALL recommended frequencies are not followed.

By letter dated August 22, 2008, the applicant responded to RAI B.2.13-5 stating that the inspection frequencies are in accordance with PPL commitments under NRC GL 89-13. The applicant further stated that inspection and cleaning frequencies are based on PPL heat exchanger's operating conditions and past history with flow rates, water quality, layup, and heat exchanger design all being considered. The applicant further stated that the frequency has been established in order to identify inherent problems before failures occur. In its response to GL 89-13, dated February 23, 1990, the applicant stated that "instead of conducting a testing program PPL committed to replacing the cooling coils of difficult to inspect heat exchangers, laboratory testing of a fouled coil and a prototype of the replacement coil, and a comprehensive program that includes scheduling of maintenance, methods of cleaning, inspection criteria, reporting, and personnel qualification. Based on past monitoring, PPL has demonstrated that existing activities and their frequency have been acceptable to detect degradation prior to the loss of component intended function and will remain adequate for the period of extended operation. The frequency of inspections is in accordance with the information provided in NRC GL 89-13."

NRC GL 89-13 Supplement 1, Section III.D.3, states, "{f}requent regular maintenance is an acceptable alternative to Recommended Action II, which calls for heat exchanger performance testing. A licensee or applicant can choose to routinely maintain the heat exchangers instead of testing them. Either the frequency of maintenance or the frequency of testing should be determined to ensure that the equipment will perform the intended safety functions during the intervals between maintenance or tests." The staff also reviewed the applicant's response to the NRC GL 89-13 and also reviewed the results of the laboratory testing that the applicant had attached to NRC GL 89-13 response.

NRC GL 89-13 Supplement 1 provides for regular maintenance and testing as an alternate for performance testing. The staff noted that the applicant performs periodic inspection in

accordance with its response to GL 89-13 and has considered flow rates, water quality, layup, and heat exchanger design when determining the frequency, and has addressed appropriate inspection and acceptance criteria. The staff reviewed the plant OE and noted that the applicant has identified and documented age related degradation as found during various inspection activities. On this basis, the staff finds that the frequencies as established by the applicant are appropriate and the Piping Corrosion Program will adequately manage age related degradation through the period of extended operation. The staff finds the applicant response to RAI B.2.13-5 to be acceptable and finds this exception to GALL AMP XI.M20 to be acceptable.

Exception 3. In a response to GL 89-13, SSES took an exception to heat transfer capability testing. The GALL AMP XI.M20, in the parameters monitored/inspected program element, recommends testing to ensure heat transfer capabilities. In LRA Section B.2.13, the applicant has not taken an exception to this program element. The staff issued RAI B.2.13-3 by letter dated May 30, 2008, requesting the applicant to justify why no exception is taken in the application.

In a letter dated June 30, 2008, the applicant responded to RAI B.2.13-3 that there is no test program at SSES to verify heat transfer capability. The applicant amended the application to include an additional exception to the Piping Corrosion Program in the "scope of program" element. The staff evaluates this exception below:

In the letter dated June 30, 2008, the applicant amended the application to include an additional exception to the Piping Corrosion Program in the "scope of program" element as follows:

> NUREG-1801 states that the guidelines of NRC GL 89-13 include a test program to verify heat transfer capabilities. There is no test program at SSES to verify the heat transfer capability. In response to GL 89-13, PPL conducted laboratory testing of cooling coils to demonstrate adequate heat transfer capability.

The applicant had performed laboratory testing of a representatively fouled ECCS room cooler cooling coil, and of prototypes representing replacement cooling coils, under post-accident conditions that demonstrated adequate heat transfer capability. This is documented in PPL correspondence to NRC dated June 11, 1992 that provided the May 1992 Confirmatory response to NRC GL 89-13. Additionally, the applicant has been monitoring heat exchangers in response to NRC GL 89-13 and has demonstrated that existing activities are able to detect degradation prior to loss of component intended function and will remain adequate for the period of extended operation.

The staff reviewed the above referenced applicant correspondence and the OE discussion that was provided in the applicant's license renewal basis document for the Piping Corrosion Program. On the basis that the applicant has met the NRC GL 89-13 recommended actions and OE has demonstrated that the program activities can detect aging degradation prior to loss of component intended function, the staff finds the applicant response acceptable and finds this exception to GALL AMP XI.M20 to be acceptable.

Based on the review, the staff finds the applicant's Piping Corrosion Program acceptable because it conforms to the recommended GALL AMP XI.M20, "Open-Cycle Cooling Water System" with enhancements and exceptions.

Enhancement 1. In the letter dated June 30, 2008, the applicant responded to RAI B.2.13-1 that the LRA Table correctly credited the Piping Corrosion Program and the basis document should have included the SGTS loop seals in the scope of the Piping Corrosion Program.

The applicant amended the LRA Section B.2.13, Piping Corrosion Program with an enhancement in the "scope of program" program element to include the SGTS loop seals. Similar changes were made to the UFSAR Supplement Section A.1.2.38 and the commitment No. 13 in LRA Table A-1.

The applicant also stated that the internal environment for the loop seals is raw water from the service water system and upon inclusion of the loop seals within the scope of the program, they will be monitored and inspected for loss of material in accordance with the specifications.

The staff reviewed the response and the associated changes to the LRA and finds the response and the changes acceptable because the applicant correctly added the SGTS loop seals to the scope of the program. The staff concurs that with the inclusion of the loop seals within the scope of the program, the Piping Corrosion Program will adequately manage the aging effects of these components similar to the other service water system components that are included in the scope of this program. Based on this review, the staff finds the enhancement acceptable because implementation of the enhancement will make the Piping Corrosion Program consistent with the GALL AMP XI.M20, "Open-Cycle Cooling Water System."

Enhancement 2. In the letter dated October 21, 2008, in response to NRC regional inspection of the LRA, the applicant added the following enhancement to the "monitoring and trending" program element of LRA Section B.2.13.

> The program will incorporate performance, documentation and trending of opportunistic visual inspections (during normal maintenance/repair activities).

The applicant also revised the UFSAR supplement and Commitment No. 13 to include this enhancement.

The staff reviewed the enhancement and associated changes and finds the response and the changes acceptable because the implementation of the enhancement will make the Piping Corrosion Program consistent with the GALL AMP XI.M20, "Open-Cycle Cooling Water System" for monitoring and trending of the inspection results.

The staff noted that the current "scope of program" program element, as described in the LRA, does not include commitments for two GL 89-13 guidelines incorporated in GALL AMP XI.M20. The specific components of the GL 89-13 program missing from the Piping Corrosion Program are a system walkdown inspection to ensure compliance with the CLB and a review of maintenance, operating, and training practices and procedures. The staff issued RAI B.2.13-2 by letter dated May 30, 2008, requesting the applicant to justify why this not an exception to the GALL AMP.

In the letter dated June 30, 2008, the applicant responded to RAI B.2.13-2 that the program description for GALL AMP XI.M20 states that the Open-Cycle Cooling Water System Program relies on implementation of the recommendations of GL 89-13. The applicant had provided responses to GL 89-13 via a series of correspondence with the NRC. The recommended action in GL 89-13 for system walkdown was documented in PPL correspondence to the NRC dated

February 23, 1990, and dated December 14, 1990. PLA-3349 also documented the recommended action for the review of the procedures. These two actions are one-time actions arising out of GL 89-13 and are unrelated to aging management.

The staff reviewed the response and the referenced applicant correspondence and finds that the applicant has taken the appropriate actions as recommended by GL 89-13 and is consistent with the GALL AMP XI.M20 program description and therefore has justified why an exception to the GALL AMP is not required. Based on this review, the staff finds the applicant's response acceptable.

Operating Experience. The staff reviewed the applicant's OE described in LRA Section B.2.13 and interviewed the applicant's technical personnel to confirm that the plant-specific OE did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are evaluated in the GALL Report.

In the "operating experience" program element of LRA Section B.2.13, the LRA states that SSES has programs in place with OE to demonstrate that the effects of aging on the service water systems, and on the safety-related heat exchangers that they serve, will be effectively managed during the period of extended operation. The staff issued RAI B.2.13-4 by letter dated May 30, 2008, requesting the applicant to provide some specific examples of issues that were found in the condition reports.

In the letter dated June 30, 2008, the applicant responded to RAI B.2.13-4 by providing several specific examples of OE. These included service water piping leaks, UT pipe wall thickness measurements that were below minimum requirements, tube wall erosion found during eddy current testing, erosion damage on end covers of heat exchangers, pitting damage on stator coolers and coatings damage on the waterbox divider. These were found during performance of testing and inspections of piping and heat exchangers. The staff finds that the applicant has provided specific plant OE and taken the appropriate corrective action to demonstrate that the effects of aging on the service water systems, and on the safety-related heat exchangers that they serve, will be adequately managed during the period of extended operation. Based on this review, the staff finds the applicant response acceptable.

The staff also reviewed the applicant's "operating experience" described in the applicant's license renewal basis document for the Piping Corrosion Program. The staff reviewed a sample of condition reports and confirmed that the applicant had identified age related degradation and implemented appropriate corrective actions.

Furthermore, the staff confirmed that the applicant has addressed OE identified after the issuance of the GALL Report. The staff finds that the applicant's Piping Corrosion Program with has been effective in identifying, monitoring, and correcting the effects of age related degradation in service water piping systems and can be expected to ensure that effects of aging will be adequately managed during the period of extended operation.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.38 and Commitment No. 13 in Table A-1 the applicant provided the UFSAR supplement for the Piping Corrosion Program. The staff verified

that the UFSAR supplement summary description for the Piping Corrosion Program was in conformance with the staff's recommended UFSAR supplement for the Open-Cycle Cooling Water System Program provided in Table 3.3-2 of the SRP-LR.

In the letters dated June 30, 2008, and October 21, 2008, the applicant amended the UFSAR supplement to include the enhancements to add Stand-By Gas Treatment System loop seals to the scope of the program and to incorporate performance, documentation and trending of opportunistic inspections and revised Commitment No. 13 in Table A-1 accordingly.

Based on this review, the staff finds that UFSAR supplement Section A.1.2.38 as amended, provides an acceptable UFSAR supplement summary description of the applicant's Piping Corrosion Program because it is consistent with those UFSAR supplement summary description in the SRP-LR for the Open-Cycle Cooling Water System Program.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. Based on the review of the applicant's Piping Corrosion Program and the applicant's response to the staff RAIs, the staff finds all program elements consistent with the GALL Report. In addition, the staff reviewed the exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that its implementation through Commitment No. 13 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement as amended for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Closed Cooling Water Chemistry Program

Summary of Technical Information in the Application. LRA, Section B.2.14 describes AMP B.2.14 "Closed Cooling Water Chemistry Program" as an existing program that is consistent with the GALL AMP XI.M21 "Closed-Cycle Cooling Water System" with an exception to the following program elements, "parameters monitored/inspected," "detection of aging effects," "monitoring and trending" and "acceptance criteria."

The applicant stated that this program is a mitigation program for damage due to loss of material and cracking for components within the closed cooling water system and for components that are served by the closing cooling water system that are exposed to treated water. The applicant also stated that the program is consistent with EPRI water chemistry guidelines that manage conditions that could lead to loss of material or cracking with the use of proper monitoring and corrosion inhibitors.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the Gall Report. AMP XI.M21, "Closed-Cycle Cooling Water System" with an exception to the following program elements: parameters monitored/inspected, detection of aging effects, monitoring and trending and acceptance criteria.

In comparing the seven program elements in the applicant's program to those in GALL AMP XI.M21, the staff noted that the program elements in the applicant's AMP claimed to be consistent with the GALL Report were consistent with the corresponding program element criteria recommended in the program elements of GALL AMP XI.M21 with the exception of one program element, "operating experience," and those exceptions taken by the applicant that the staff felt there was a need for additional clarification and for which RAIs were issued. The staff also issued an RAI to clarify statements made by the applicant in LRA Section B.2.14 pertaining to a supplemental one-time inspection. The "operating experience" program element is discussed separately below.

Based on the staff's review of LRA Section B.2.14, the staff noted that the applicant states that the Closed Cooling Water Chemistry Program is supplemented by a one-time inspection to ensure the effectiveness of the program, either the AMP B.2.22 "Chemistry Program Effectiveness Inspection" or the AMP B.2.24 "Heat Exchanger Inspection." The staff determined that clarification was needed and, therefore, by letter dated July 10, 2008, the staff issued RAI B.2.14-2 requesting the applicant to clarify if the appropriate one-time inspection will be performed for all AMR Table 2 line items credited with using AMP B.2.14 and to identify which one-time inspection, if any, will be used for any applicable AMR Table 2 line items that credit AMP B.2.14 for aging management. The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff noted that the one-time inspection will not be performed on the Diesel Jacket Water Cooling System because corrosion monitoring probes were installed to identify actual corrosion rates. The staff further noted that these probes were installed following an inspection performed at the same time as a 20-year overhaul of the system. The staff confirmed that the applicant amended the LRA to indicate that AMP B.2.22 will supplement AMP B.2.14, in order to perform a one-time inspection to identify degradation or confirm the lack of degradation. On the basis of its review, the staff finds the applicant's response acceptable because the applicant has clarified that the AMP B.2.22, "Chemistry Program Effectiveness Inspection" is the one-time inspection that will supplement AMP B.2.14, unless otherwise noted, which will be capable of identifying any evidence or confirm the lack of any degradation that is occurring that may affect the intended functions of those components that credit AMP B.2.14 for aging management, during the period of extended operation.

The staff reviewed the exception to determine whether the program, with exception, is adequate to manage the aging effects for which it is credited.

Exception. GALL AMP XI.M21 recommends the use of performance and functional testing to ensure the "acceptable functioning" of the closed cooling water system or components served by this system. The staff noted that the applicant's program takes an exception to the "parameters monitored/inspected," "detection of aging effects," "monitoring and trending" and "acceptance criteria" program elements in that performance and functional testing will not be performed.

The staff also noted that the applicant's program will monitor the emergency diesel generator jacket water subsystem and heat-exchangers served by the closed cooling waters which are supplemented by a one-time inspection to confirm the effectiveness of AMP B.2.14. Therefore, by letter dated July 10, 2008, the staff issued RAI B.2.14-1 requesting the applicant to clarify whether or not performance and functional testing are within the scope of the closed cooling

water chemistry program, and if not to provide the basis for not including them in the scope of the program. The staff further asked the applicant in RAI B.2.14-1 to clarify whether the one-time inspection is being performed instead of the periodic inspections recommended in GALL AMP XI.M21 and if so, to justify how a one-time inspection is capable of accomplishing the same tasks as the periodic inspections recommended by the GALL Report. Additionally, the staff asked the applicant to clarify how a one-time inspection would be capable of trending corrosion data for the components within scope of the program when only one round of inspections are performed.

The applicant responded to RAI B.2.14-1 in a letter dated August 12, 2008. In this letter the applicant stated that the conditions that could lead to the onset and the spread of loss of material and cracking are managed by the proper control and monitoring of corrosion inhibitors in accordance with EPRI water chemistry guidelines. The applicant further stated that system parameters would only be affected when the degradation in the system had progressed to a significant amount. The staff noted that the applicant will control the water chemistry in accordance with EPRI guidelines, industry and plant-specific OE and periodic evaluation of the water chemistry parameters. The staff noted that the applicant has performed a review of its plant-specific OE, which indicated that the aging effects of loss of material and cracking are not expected to occur and the Closed Cooling Water Chemistry Program has been effective is mitigating these aging effects. The applicant stated in the LRA that they will be performing a one-time inspection with the AMP B.2.22 "Chemistry Program Effectiveness Inspection" to identify evidence or confirm the lack of any degradation that is occurring that may affect the intended functions of these components during the period of extended operation. The applicant stated that this one-time inspection will inspect a representative sample of components that are exposed to low flow and stagnant areas where accumulation of contaminants might occur making these components more susceptible to loss of material and components that are exposed to temperatures greater than 140°F which are susceptible to cracking. The staff noted that this one-time inspection will utilize a combination of volumetric and visual inspection techniques (such as VT-1 or VT-3). The staff noted that in most cases the use of functional and performance testing will verify that the component's active functions can be accomplished. The staff further noted that testing the active functions of components with performance and functional testing are governed by the requirements of the Maintenance Rule (10 CFR 50.65). By letter dated September 30, 2008, as a result of a NRC Regional Inspection the applicant amended this exception in LRA Section B.2.14 in which the applicant clarified that periodic inspections will not be performed, however based on the implementation and inspection results from the one-time inspection that will be performed as part of AMP B.2.22 this may result in the establishment of periodic inspection activities. On the basis of its review, the staff finds the applicant's response acceptable because (1) the applicant will be monitoring and maintain the water chemistry in accordance with EPRI guidelines (2) will be performing a one-time inspection in accordance with the recommendations of GALL AMP XI.M32 "One-Time Inspection" to identify evidence or confirm the lack of any degradation that is occurring that may affect the intended functions of the these components during the period of extended operation and (3) the applicant may establish periodic activities based on the implementation and inspection results from the one-time inspection performed as part of AMP B.2.22.

On the basis of its review, the staff finds the applicant's exception acceptable because (1) the applicant will monitor and maintain water chemistry in accordance with the EPRI guidelines to mitigate loss of material and cracking which has been proven to be successful based on plant-specific OE, (2) the applicant will be performing a one-time inspection in accordance with the recommendations of GALL AMP XI.M32 "One-Time Inspection" for the aging effects of loss of material and cracking, and (3) the applicant will be selecting representative sample of

components with low-flow and stagnant areas which are more susceptible to degradation because of accumulating contaminants for the one-time inspections.

Operating Experience. The staff reviewed the applicant's OE described in the applicant's license renewal basis document for the Closed Cooling Water Chemistry Program. The applicant stated in the LRA that this program incorporates EPRI closed cooling water guidelines and also has been incorporating site-specific and industry wide OE. The staff noted that the applicant performs periodic external and internal assessments of the program's performance to identify any strengths and adverse trends.

During its review, the staff noted that the OE revealed issues with the diesel jacket water corrosion/microbiological control in 1999 and some degradation of components were noted by inspections during a 20-year overhaul during the same time period. The applicant took corrective actions by flushing the jacket water and considered different biocide/corrosion inhibitor treatments. The staff noted that the applicant installed instantaneous corrosion probes to monitor corrosion rates. However the staff determined that additional information was needed for its review and therefore, by letter dated July 10, 2008, the staff issued RAI B.2.14-3 requesting the applicant to clarify whether the addition of alternative biocides or corrosion inhibitors was actually implemented as a corrective action for the diesel jack water system components that are exposed to closed cooling water. If so, clarify whether any supplemental inspections have been performed since the time of the change in the biocide control compound or corrosion inhibitor to verify its effectiveness in managing microbiological organism growth or corrosion of the component surfaces that are exposed to closed cooling water; if not, and a change in biocide control compound or corrosion inhibitors is planned, clarify when the change will be performed and whether any supplemental inspections are planned to confirm its effectiveness to manage microbiological organism growth or corrosion in the components. The applicant responded to RAI B.2.14-3, by letter dated August 12, 2008. The applicant stated that during 1999 the biocide treatment used by SSES was glutaraldhyde, but was discontinued and changed to the alternative biocide isothiazoline. The staff noted that this alternative biocide is currently in use and since its implementation in 1999, the more recent supplemental inspections of the diesel generators have indicated no significant degradation. The applicant stated that the supplemental inspections were performed to confirm the effectiveness of this new biocide treatment. The applicant stated that the recent review in 2007 of the water chemistry samples have shown that the chemistry parameters have been maintained in specification, corrosive metal levels are low, and biological activity is negligible. On the basis of its review, the staff finds the applicant's response acceptable because the applicant took corrective actions with the use of alternate biocide treatments following the discovery of degradation in the diesel jacket cooling water system and recent inspections have shown no significant degradation in the system.

The staff finds the applicant's Closed Cooling Water Chemistry Program has been effective in identifying, monitoring and correcting the effects of aging and the existing program OE did not reveal any degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. The staff reviewed the UFSAR Supplement summary description that was provided in LRA Section A.1.2.13 and Commitment No. 45 in Table A-1 for the Closed Cooling Water Chemistry Program. The staff verified that, in LRA Commitment No. 45 of UFSAR

Supplement Table A-1, the applicant committed to the ongoing implementation of the Closed Cooling Water Chemistry Program for aging management of those in-scope components that the AMP is credited. The staff also verified that the applicant has placed this commitment on UFSAR Supplement summary description A.1.2.13 for the Closed Cooling Water Chemistry Program.

Based on this review, the staff finds that UFSAR Supplement Section A.1.2.13 provides an acceptable UFSAR Supplement summary description of the applicant's Closed Cooling Water Chemistry Program because it is consistent with the UFSAR Supplement summary description in the SRP-LR and because the summary description includes the bases for determining that aging effects will be managed. Therefore, the staff concludes that the UFSAR supplement for this AMP provides an adequate summary description of the program, as described by 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's Closed Cooling Water Chemistry Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception , the justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. In addition the staff reviewed the applicant's responses to the staff's RAI and its evaluation is documented above. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Fire Protection Program

Summary of Technical Information in the Application. LRA Section B.2.16 describes the Fire Protection Program as an existing program that is consistent with an exception with the GALL AMP XI.M26, Fire Protection. The applicant stated that this program performs periodic visual inspections and functional tests, as appropriate, of fire dampers, fire barrier walls, ceilings and floors, fire rated penetration seals (fire stops), fire wraps, fireproofing, and fire doors to ensure that functionality and operability are maintained.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant's program to those in GALL AMP XI.M26, the staff noted that the program elements in the applicant's AMP claimed to be consistent with GALL were consistent with the corresponding program element criteria recommended in the program elements of GALL AMP XI.M26. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report. Onsite interviews were also held to confirm these results.

The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Exception 1. In the LRA, the applicant identified the following exception to the "scope", "parameters monitored/inspected," "detection of aging effects," "monitoring and trending" and "acceptance criteria" program elements:

With respect to the halon/carbon dioxide (CO_2) suppression systems and the fuel oil supply line for the diesel-driven fire pump, inspections and tests included in the Fire Protection Program (and addressed in the Technical Requirements Manual) are not credited with aging management but do provide for periodic observation of the related components. While halon/CO_2 and fuel supply line internal conditions are not directly inspected or evaluated during these tests and inspections, they do provide indirect confirmation of whether degradation has occurred, prior to a loss of function.

The staff issued RAI B.2.16-1 by letter dated May 30, 2008, requesting the applicant to provide justification why these tests and inspections are not credited for license renewal, and why the internal surfaces are not inspected.

In the letter dated June 30, 2008, the applicant stated in response to part a.1 of RAI B.2.16-1 that Halon/CO_2 spray nozzles, tubing and valve body fabricated from stainless steel and copper alloy are not susceptible to aging in indoor air environment. The staff reviewed the GALL Report and noted that items VII.J-15 and V.F-3 identify no aging effects for stainless steel and copper alloy material in indoor air external environment. The applicant stated in part a.2 of RAI B.2.16-1 that consistent with the GALL Report; there are no aging effects for material in a dry gas internal environment. The staff reviewed the GALL Report and noted that items VII.J-4 and VII.J-19 identify no aging effect for a dry gas environment. The applicant further stated in part a.3 of RAI B.2.16-1 that the System Walkdown Program is credited for managing the aging effects on the external surfaces of steel components in Halon/CO_2 system. The staff noted that this is consistent with the GALL Report that recommends the GALL AMP XI.M36, External Surfaces Monitoring.

The applicant finally stated in response to part b of RAI B.2.16-1 that for the diesel engine-driven fire pump, the Fuel Oil Chemistry Program and Chemistry Program Effectiveness Inspection are credited to manage the aging effects. The staff reviewed LRA Table 3.3.2-13 and noted that aging effects of copper tubing in a fuel oil environment is managed by the Fuel Oil Chemistry and Chemistry Effectiveness Inspection Programs, which is consistent with the GALL Report.

Because the applicant is consistent with the GALL Report recommendations, the staff finds the applicant response acceptable and concurs that because there are no aging effects, the internal surfaces of Halon/CO_2 system components do not need to be inspected and the internal surfaces of diesel engine-driven fire pump tubing are inspected as part of the sample population in the Chemistry Effectiveness Inspection Program. Based on this review, the staff finds this exception acceptable.

Based on the review of the exception, and resolution of the related RAI as described above, the staff finds the Fire Program consistent with program elements of GALL AMP XI.M26, with acceptable exceptions, and therefore acceptable.

Operating Experience. The staff reviewed the applicant's OE described in LRA Section B.2.16 and interviewed the applicant's technical personnel to confirm that the plant-specific OE did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are evaluated in the GALL Report.

The staff also reviewed the applicant's OE described in the applicant's license renewal basis document for the Fire Protection Program. The staff reviewed a sample of condition reports and confirmed that the applicant had identified age related degradation and implemented appropriate corrective actions. The staff found examples of fire door issues, penetration seal cracking and fire door seal degradation. The staff noted that several condition reports have been written against fire door degradation that determined that the fire door degradations were related to human performance and inadequate fire door installation. Isolated cases of fire rated penetration seal cracking and fire door seal degradation have also been identified. Corrective actions included additional personnel training, repair, and/or replacement activities. The staff did not find any age related degradation in Halon/CO_2 systems.

Furthermore, the staff confirmed that the applicant has addressed OE identified after the issuance of the GALL Report. The staff finds that the applicant's Fire Protection Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of age related degradation in fire protection systems and can be expected to ensure that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A1.2.18 and Commitment No. 15 in Table A-1, the applicant provided the UFSAR supplement for the Fire Protection Program. The staff verified that the UFSAR supplement summary description for the Fire Protection Program was in conformance with the staff's recommended UFSAR supplement for the Fire Protection Program provided in Table 3.3-2 of the SRP-LR. In Table A-1, the applicant has committed via Commitment No. 15 to implement the existing program through the period of extended operation.

Based on this review, the staff finds that UFSAR supplement Section A1.2.18 provides an acceptable UFSAR supplement summary description of the applicant's Fire Protection Program because it is consistent with those UFSAR supplement summary description in the SRP-LR for the Fire Protection Program.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's Fire Protection Program and the applicant's response to the staff's RAI, the staff finds all program elements consistent with the GALL Report. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Fire Water System Program

Summary of Technical Information in the Application. LRA Section B.2.17 describes the Fire Water System Program as an existing program that is consistent with enhancements with the GALL Report AMP XI.M27, Fire Water System. The applicant stated that this program performs periodic inspection and testing of the water-based fire suppression systems including hydrant and hose station inspections, fire main flushing, flow tests, and sprinkler inspections. The applicant also stated that tests and inspections are generally in accordance with the applicable National Fire Protection Association (NFPA) recommendations.

Staff Evaluation. During its audit the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements to determine whether the AMP, with the enhancements is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant's program to those in the GALL AMP XI.M27, the staff noted that the program elements in the applicant's AMP which claimed to be consistent with the GALL Report were consistent with the corresponding program element. However the "scope of program" program element aspect as identified below the staff determined needed additional clarification. The staff also confirmed that the plant program contains all of the elements of the referenced the GALL Report. Onsite interviews were also held to confirm these results.

The LRA credits the Fire Water System Program for managing loss of material for valve bodies (deluge) in the SGTS. However, the staff noted the SGTS is not included in the list of systems in the scope of this program, as identified in the program basis document. The staff issued RAI B.2.17-1 by letter dated May 30, 2008, requesting the applicant to clarify why the SGTS is not in-scope.

In the letter dated June 30, 2008, the applicant responded to RAI B.2.17-1 by stating that the SGTS components are included in the scope of the Fire Water System Program. The applicant also stated that these components include piping and valves associated with deluge of the charcoal absorbers. However, since LRA Table 3.2.2-7 only addressed deluge valves, the LRA Table was amended to include carbon steel deluge piping. The applicant also stated that it credited the Fire Water System Program to manage loss of material for internal surfaces in a raw water environment, and the System Walkdown Program to manage loss of material of external surfaces in an indoor air environment.

Because the added AMR line item is consistent with the GALL Report line VII.G-24 for internal surfaces, and V.B-3 for external surfaces, the staff finds the addition of this line to be acceptable. However, the response did not indicate whether the LRA will be amended to include the SGTS within the scope of the program or provide justification why it was not included. The staff issued a follow-up RAI B2.17-1R by letter dated July 23, 2008, to resolve this issue.

In the letter dated August 22, 2008, the applicant responded to RAI B2.17-1R by stating that LRA Section B.2.17, Fire Water System Program is an existing program. The specific systems within the scope of the program are not included in the LRA, however, these systems are identified in the program basis document. The applicant acknowledged that the SGTS should have been included in the program basis document, but was inadvertently omitted. The applicant stated that the deluge valves and piping, located in the fire protection lines to the high efficiency charcoal adsorber filters, were evaluated with SGTS but is subject to the raw water environment of the fire protection system and therefore credited the Fire Water System

Program. The applicant also stated that the SGTS deluge valves and piping are included in the LRA Table 3.2.2-7, are identified in the Technical Requirements Manual Table 3.7.3.2-1, and are included in the fire water system procedure that performs the 18-month functional test and the 18-month visual inspection of the SGTS deluge system.

The staff noted that the valves and piping in question are located in an environment of fire water but evaluated in the SGTS AMR, and that these lines are included in the fire protection system testing and inspection procedures as per the requirements in the Technical Requirements Manual. On this basis, the staff finds that enhancement to the program is not needed and finds the applicant response to be acceptable.

LRA Table 3.3.2-13 credits the Fire Water System Program to manage reduction in heat transfer for heat exchanger tubes. However, LRA Section B.2.17 states that this program is consistent with the GALL AMP XI.M27, which focuses on managing the aging effect of loss of material and not reduction in heat transfer. The staff issued RAI B.2.17-2 by letter dated May 30, 2008, requesting the applicant to justify how this program will manage reduction in heat transfer.

In the letter dated June 30, 2008, the applicant responded to RAI B.2.17-2 by stating that upon further consideration, the Heat Exchanger Inspection Program has been identified as a more appropriate program for managing reduction of heat transfer for the diesel engine driven fire pump heat exchangers. The applicant amended the LRA to credit the Heat Exchanger Inspection Program in lieu of the Fire Water System Program. The evaluation of the Heat Exchanger Program is documented in SER Section 3.0.3.1.12.

The staff reviewed the enhancements to determine whether the AMP, with the enhancements, is adequate to manage the aging effects for which the LRA credits it.

Enhancement 1. In LRA Section B.2.17, the applicant added a program requirement in the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements to require testing or replacement of sprinkler heads in service for 50 years.

The GALL AMP XI.M27 recommends testing or replacement of sprinkler heads in service for 50 years. On the basis that the enhancement, when implemented, will make the Fire Water System Program consistent with the GALL Report, the staff finds the enhancement acceptable.

Enhancement 2. In LRA Section B.2.17, the applicant added a program requirement in the "parameters monitored or inspected" and "detection of aging effects" program elements to perform ultrasonic testing of representative portions of above ground fire protection piping that are exposed to water but do not normally experience flow.

By letters dated June 30, 2008, in response to RAI B.2.17-3 and October 21, 2008, in response to NRC regional inspection of the LRA, the applicant amended the LRA to revise Enhancement 2 as follows:

> Ultrasonic testing of representative portions of above ground fire protection piping that are exposed to water but do not normally experience flow, are associated with a dry-piping sprinkler system and may contain stagnant water, or is pre-action or deluge piping that is normally dry, but may have been wetted and not completely dry, will be performed after the issuance of the renewed license

but prior to the end of the current operating term and at reasonable intervals thereafter, based on engineering review of the results.

The GALL AMP XI.M27 recommends wall thickness evaluations of fire protection piping using non-intrusive testing (e.g., ultrasonic testing) to identify loss of material due to corrosion. By performing this testing on piping that does not normally experience flow, or may contain stagnant water or may have been wetted but not completely dry, the applicant has selected locations that would experience a more aggressive internal environment than piping with full flow. On the basis that the enhancement, when implemented, will make the Fire Water System Program consistent with the GALL Report, the staff finds the enhancement acceptable.

Enhancement 3. By letter dated October 21, 2008, in response to NRC regional inspection of the LRA, the applicant amended the LRA to add another enhancement as follows:

> Also, within the 10-year period prior to the period of extended operation, at least one visual inspection (opportunistic or focused) of the internal surface of buried fire water piping will be performed. In addition, at least one inspection per year of 'wet' fire protection piping for wall thickness and pipe blockage will be performed if no opportunistic inspection has been completed.

The applicant also revised the UFSAR supplement and the commitment list to include this enhancement.

The GALL AMP XI.M27 recommends that as an alternative to non-intrusive testing, the plant maintenance process may include a visual inspection of internal surface of the fire protection piping upon each entry to the system for routine or corrective maintenance. By performing the visual inspection on an opportunistic or focused basis on selected representative locations, and on the basis that the enhancement, when implemented, will make the Fire Water System Program consistent with the GALL Report, the staff finds the enhancement acceptable.

Based on its review, the staff finds the applicant's Fire Water System Program acceptable because it conforms to the recommended GALL AMP XI.M27, Fire Water System with enhancements.

Operating Experience. The staff reviewed the applicant's OE described in LRA Section B.2.17 and interviewed the applicant's technical personnel to confirm that the plant-specific OE did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are evaluated in the GALL Report. Furthermore, the staff confirmed that the applicant has addressed OE identified after the issuance of the GALL Report. In the "operating experience" element of LRA Section B.2.17, the LRA states that a search of condition reports was performed for the Fire Protection System. When conditions were found that required correction they were repaired in accordance with the site corrective action program. However, the applicant did not provide any specific OE related to the Fire Water System Program. The staff issued RAI B.2.17-3 requesting the applicant to provide some specific examples of issues that were found in the condition reports.

In the letter dated June 30, 2008, the applicant responded to RAI B.2.17-3 by providing several specific examples of plant OE. The applicant stated that small leaks were identified in different fire protection piping, which were repaired or the piping replaced; and ultrasonic inspection was performed on surrounding areas as part of the corrective action.

On the basis that the applicant has identified specific examples of plant OE and corrective actions taken, the staff finds the applicant response acceptable.

The staff reviewed some condition reports as part of the OE review and found that several CRs were written to address through wall leaks in fire water headers in the circulating water pumphouse area. Stagnant water in low drainage locations inside the pumphouse was determined to be the cause. The staff issued RAI B.2.17-4 requesting the applicant to address this issue, (a) to determine what changes are proposed and (b) if these locations are included in the representative sample picked for UT inspections for wall thickness measurements.

In the letter dated June 30, 2008, the applicant responded to RAI B.2.17-4 by stating that no changes were proposed to the fire water system to alleviate through wall leaks. The applicant stated that the leaks were observed in piping that is normally dry, however, stagnant water collected in low drainage locations, which made the piping system more susceptible to corrosion. The applicant further stated any leaking piping is identified to engineering for evaluation, including an operability evaluation. The applicant further stated that the Fire Water System program manages the aging by performing evaluations of issues that are identified during station activities. The applicant amended LRA Section B.2.17, Fire Water System Program, to revise the enhancement for wall thickness measurement by UT, to include representative portions of above ground piping in the dry-pipe sprinkler system, which may contain stagnant water. The applicant also revised the UFSAR Supplement and the Commitment List to include the revised enhancement.

The staff reviewed the amendment and finds that with the changes to the enhancement to include stagnant water locations in the representative sample for UT, the Fire Water System Program will provide further assurance that aging effects are managed and these components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. Based on this review, the staff finds the applicant response acceptable.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.19, Commitment No. 46 in Table A-1, and letters dated June 30, 2008, and October 21, 2008, the applicant provided the UFSAR supplement for the Fire Water System Program. The staff verified that the UFSAR supplement summary description for the Fire Water System Program was in conformance with the staff's recommended UFSAR supplement for the Fire Water System Program provided in Table 3.3-2 of the SRP-LR.

The applicant committed to enhance its program to require testing or replacement of sprinkler heads in service for 50 years, and to perform UT of representative portions of above ground fire protection piping that are exposed to water but do not normally experience flow or are associated with a dry-pipe sprinkler system and may contain stagnant water, or is pre-action or deluge piping that is normally dry, but may have been wetted and not completely dry. The applicant also committed to enhance its program to perform within the 10-year period prior to the period of extended operation, at least one visual inspection (opportunistic or focused) of the internal surface of buried fire water piping, and at least one inspection per year of 'wet' fire

protection piping for wall thickness and pipe blockage if no opportunistic inspection has been completed.

Based on this review, the staff finds that UFSAR supplement Section A.1.2.19 provides an acceptable UFSAR supplement summary description of the applicant's Fire Water System Program because it is consistent with those UFSAR supplement summary description in the SRP-LR for the Fire Water System Program.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's Fire Water System Program, and the applicant's response to the staff's RAIs, the staff finds all program elements consistent with the GALL Report. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 46 prior to the period of extended operation will make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement, as amended, for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Buried Piping Surveillance Program

Summary of Technical Information in the Application. The LRA Section B.2.18 described the new Buried Piping Surveillance Program as consistent with GALL AMP XI.M28, "Buried Piping and Tanks Surveillance," with an exception. This program consists of a prevention program (consisting of cathodic protection) and a condition monitoring program (consisting of periodic testing) to manage the loss of material on external surfaces of piping with damaged coatings.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report. Onsite interviews were also held to confirm these results.

In comparing the elements in the applicant's program to those in GALL AMP XI.M28, the staff noted that the program elements in the applicant's AMP claimed to be consistent with GALL were consistent with the corresponding program element criteria recommended in the program elements of GALL AMP XI.M28 with the exception of the "scope of program" program element aspect as identified below.

The staff reviewed the exception to determine whether the AMP, with the exception will be adequate to manage the aging effects for which the LRA credits.

Exception. The applicant stated an exception to the "scope" program element stating that the "scope of program" element is limited to the sections of buried RHRSW and ESW common return header piping for which damaged coatings are known to exist. Therefore, the applicant does not credit coatings in this program for aging management. All other buried piping and tanks subject to aging management are managed by the Buried Piping and Tanks Inspection Program. The staff did not agree that this is an exception to the GALL AMP because the GALL Report recommends either the use of the Buried Piping and Tanks Surveillance Program or the Buried Piping and Tanks Inspection Program for buried piping and tanks. The staff discussed

this issue with the applicant and followed up with RAI B.2.18-1 in a letter dated June 13, 2008, that asked the applicant to explain why this is an exception to the GALL Report AMP. In the applicant's response to this RAI in a letter dated July 14, 2008, the applicant agreed that this should not be an exception and amended the LRA to state under "[e]xceptions to NUREG-1801," "None."

On the basis of the review, the staff concludes that the applicant's Buried Piping Surveillance Program provides assurance that either the aging effect is indeed not occurring, or that the aging effect is occurring so slowly as not to affect the intended function of the component or structure. The staff finds the applicant's Buried Piping Surveillance Program acceptable because it conforms to the recommended GALL AMP XI.M28, Buried Piping Surveillance Program following resolution of the RAI.

The staff has identified one additional area of concern that relates to the rectifiers and the ground bed anodes and all other equipment associated with the implementation of this AMP. The staff assumes that these components are not currently safety-related and are not covered by the 10 CFR Appendix B program as discussed in Appendix B.1.3 of the LRA. RAI B.2.18-2 was issued to the applicant by a letter dated June 13, 2008, and requested the applicant to clarify whether these components will remain nonsafety-related, but now fall under the 10 CFR Part 50 Appendix B program, or whether they will be upgraded to safety-related. In addition, the staff asked the applicant to indicate whether the failure of one of these components will initiate a technical specification limited condition of operation and whether there will be a commitment to cover this equipment under the SSES 10 CFR Appendix B program. In its response dated July 14, 2008, the applicant responded to RAI B.2.18-2 by stating that rectifiers, ground bed anodes, and other equipment in-scope for AMP B.2.18 are nonsafety-related and that failure of these components does not result in entry into a technical specification limited condition of operation. The applicant also stated that the cathodic protection system has no safety-related function but are in-scope for license renewal under 10 CFR Part 54.4(a)(2). In the LRA Section B.1.3, the applicant states:

> "The elements of corrective actions, confirmation process, and administrative controls in the SSES QA Program will be applied to each existing, enhanced, and new aging management program and activity credited for license renewal, for both safety-related and nonsafety-related structures and components determined to require aging management during the period of extended operation."

The staff noted the systems and components used as part of the Buried Piping Surveillance Program are in-scope for 10 CFR Part 50 Appendix B and there will be no changes to the LRA as a result of this response.

The staff requested this information for clarification and the applicant's response addressed the staff's questions and concerns. On the basis of its review, and because the applicant has included all SSCs in-scope for license renewal under its existing 10 CFR Appendix B Program regardless of safety classification, the staff finds the applicant's response acceptable.

Operating Experience. The staff also reviewed the applicant's OE, including a sample of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. In the application, the applicant stated that there is no OE demonstrating the effectiveness of the program because it is a new program.

The applicant stated that the Buried Piping Surveillance Program is a new program for which there is no OE and that inspection methods will be consistent with accepted industry practices. For this program and for other new AMPs where the applicant provided no current plant-specific OE, the staff issued RAI B.2.1 by letter dated June 10, 2008, asking that the applicant commit to provide documentation of plant-specific operating experience for staff review after the program has been implemented, but prior to entering the period of extended operation.

In its letter dated July 8, 2008, the applicant stated that OE for new AMPs described in LRA Appendix B will be gained as these new programs are implemented during the period of extended operation. The applicant stated that results of tests, inspections, and other aging management activities conducted in accordance with these programs will be subject to confirmation and corrective action elements of the Susquehanna 10 CFR Part 50, Appendix B, quality assurance program and that results will be subject to NRC review during regional inspections under existing NRC inspection modules. The applicant stated that these new programs will be implemented prior to, and continue through, the period of extended operation and that OE will be gained for these programs as they are implemented. The applicant further stated that test and inspection results that do not meet acceptance criteria for these new programs will be evaluated under the station's corrective action program, which includes requirements for identification of appropriate corrective actions and verification of the effectiveness of corrective actions.

The staff noted that the applicant's statement that inspection methods will be consistent with industry practices is consistent with the "operating experience" program element for GALL AMP XI.28. The staff also noted that post-approval site inspections provide an opportunity for staff review and assessment of the effectiveness of the applicant's Buried Piping Surveillance Program after the applicant has developed OE with that program. The staff concludes that the corrective action program, based on internal and external plant OE, would capture OE in the future to support the conclusion that the effects of aging are adequately managed. On this basis, the staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable and concludes that a separate commitment is not necessary.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.4 and Commitment No. 16 in Table A-1, the applicant provided the UFSAR supplement for the Buried Piping Surveillance Program. The staff reviewed this section and determined that the information in the UFSAR Supplement provides an adequate summary description of the program consistent with the SRP-LR and as required by 10 CFR 54.21(d).

Conclusion. The staff has reviewed the information provided in Section B.2.18 of the LRA Appendix B and additional information provided by the applicant by letter dated July 14, 2008. On the basis of its review as discussed above, the staff concludes that the applicant has demonstrated that effects of aging of the buried piping will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed UFSAR supplement and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. LRA Section B.2.20 describes the existing Fuel Oil Chemistry Program as consistent, with exceptions, with GALL AMP XI.M30, "Fuel Oil Chemistry." The applicant stated that the program is a mitigation program that manages potential aging effects for plant components in a fuel oil environment. The applicant also stated that the program manages loss of material and cracking through monitoring and control of fuel oil contamination, such as water or microbiological organisms, consistent with pertinent plant technical specifications/requirements and American Society for Testing of Materials (ASTM) standards. The applicant further stated that exposure to contaminants is minimized by verifying the quality of new fuel oil before it enters the storage tanks and by periodic sampling to ensure that the tanks are free of water and particulates.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the applicant's AMP evaluation report for the Fuel Oil Chemistry Program, together with implementing procedures and supporting documentation related to the program. The staff did not identify any issues requiring further resolution or clarification for elements of the program that the applicant claimed to be consistent with the corresponding program element criteria in GALL AMP XI.M30.

The applicant's Fuel Oil Chemistry Program, as described in the LRA, includes three (3) exceptions to the GALL Report identified by the applicant. These exceptions affect the "scope of program," the "parameters monitored/inspected" and "acceptance criteria," and the "monitoring and trending" program elements of the AMP. In response to an issue raised during a regional inspection of the applicant's program, the applicant identified an additional exception to the "acceptance criteria" program element and revised the LRA to identify this fourth exception. The staff reviewed the four (4) exceptions to determine whether the AMP, with exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff's evaluation of the exceptions is presented in the following paragraphs.

Exception 1. LRA Section B.2.20 states an exception to the "scope of program" program element. The applicant stated that although its Fuel Oil Chemistry Program largely focuses on fuel oil tanks, the program is also applicable to other components exposed to fuel oil, including the fuel oil supply components of the diesel engine-driven fire pump. The applicant categorized expansion of the Fuel Oil Chemistry Program to include oil supply components of the diesel engine-driven fire pump as an exception to the GALL Report.

In evaluating this exception, the staff noted that in the GALL Report the "scope of program" program element for GALL AMP XI.M30 focuses exclusively on managing the aging of the interior surfaces of the diesel generator fuel oil supply tanks. The staff also noted that the material, environment and potential aging effects are identical for both the diesel generator fuel oil supply components and the diesel engine-driven fire pump fuel oil supply components and that GALL Table VII.G, item VII.G-21 credits use of the Fuel Oil Chemistry Program for aging management in the fire protection system. On the basis that the expanded scope of the applicant's Fuel Oil Chemistry Program encompasses components with material, environment and potential aging effects identical to the components explicitly identified in the GALL Report, the staff finds the "scope of program" of the applicant's Fuel Oil Chemistry Program, including this exception to the GALL Report, to be acceptable.

Exception 2. LRA Section B.2.20 states an exception to the "parameters monitored/inspected" and the "acceptance criteria" program elements. The applicant stated that with respect to the test described in ASTM Standard D2276-00, "Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling," their program uses the 0.8 µm pore size filter called out in the ASTM standard, rather than the 3.0 µm pore size filter recommended in the GALL Report's description for this program element.

The applicant categorized the use a filter pore size different from what is recommended in the GALL Report as an exception to the "parameters monitored/ inspected" and the "acceptance criteria" program elements as described in the GALL Report.

The staff reviewed ASTM Standard D2276-00 and noted that the standard provides a method for gravimetric measurement of particulate matter in diesel fuel by comparing the weight of a test filter on which particulate matter is collected against the weight of a control filter through which the filtered fuel is subsequently passed, then converting the measurements to milligrams of particulate per liter of filtered fuel. The standard states that tolerable levels of particulate contaminants have not yet been established for all points in fuel distribution systems. Since specific levels of particulate are not specified by the standard, the primary purpose of the test is to ensure that particulate contamination is not increasing outside its normal operating range. The staff noted that use of a filter with different pore size from what is recommended in the GALL Report does not invalidate the test procedure, and that the applicant's use of a filter with smaller pore size than what is recommended in the GALL Report provides a conservative measurement of particulate concentration relative to the methodology recommended in the GALL Report. Because the test methodology remains valid with the smaller pore filter and the measurements with the smaller pore filter are conservative relative to the GALL Report's recommendation, the staff finds the "parameters monitored/inspected" and the "acceptance criteria" elements of the applicant's Fuel Oil Chemistry Program to be acceptable.

Exception 3. LRA Section B.2.20 states an exception to the "monitoring and trending" program element. The applicant stated that an annual frequency for sampling of fuel for biological activity is used, along with monthly or quarterly sampling for other contaminants. This is an exception to the GALL Report's recommendation that water and biological activity or particulate contamination concentrations be monitored and trended in accordance with the plant's technical specifications or at least quarterly.

The staff reviewed the applicant's technical specifications and technical requirements manual and noted that sampling is specified to be done in accordance with industry standards, but no specific frequency of sampling for biological activity is identified in those documents. The staff issued RAI B.2.20-1 by letter dated June 23, 2008, asking the applicant what ASTM standard is used to establish frequency for monitoring fuel oil for biological activity and to provide a basis and technical justification for its current sampling frequency if no such standard exists or is used.

The applicant responded in a letter dated July 17, 2008. In that letter the applicant provided the following discussion in response to RAI B.2.20-1:

> The schedule for sampling the emergency diesel generator fuel oil in the fuel oil storage tanks for biological activity was changed from annually to quarterly in 2007. No ASTM standard was identified since the sampling frequency now matches the frequency recommended by GALL. The exception to monitoring and trending is no longer needed and is deleted.

The following changes are made to the LRA to delete the monitoring and trending exception for the Fuel Oil Chemistry Program.

The third bullet under the Exceptions to NUREG-1801, in Section B.2.20 (LRA Page B-65) is revised by deletion [in its entirety].

On the basis that the applicant revised the fuel oil sampling frequency for biological activity to be consistent with the recommendations in the GALL Report and revised the LRA to delete the previously identified exception, the staff finds the "monitoring and trending" program element of the applicant's Fuel Oil Chemistry Program to be acceptable.

Exception 4. In a letter dated October 21, 2008, the applicant identified an additional exception to the "detection of aging effects" program element. The applicant stated that UT thickness measurements are not taken on the bottoms of the diesel generator fuel oil storage tanks because the fuel oil storage tanks are buried and inaccessible; also internal surfaces are coated, and coatings would have to be removed in order to perform UT examinations. The applicant stated that UT examinations of diesel generator fuel oil day tank bottoms will be conducted as part of the Chemistry Program Effectiveness Inspection. The applicant also made changes to LRA Section B.2.22, Chemistry Program Effectiveness Inspection, to state that the bottom of at least two diesel generator fuel oil day tanks will be examined by UT measurements as part of the CPEI AMP.

In the GALL Report the "detection of aging effects" program element states that degradation of the diesel fuel oil tank cannot occur without exposure of the tank internal surfaces to contaminants such as water and microbiological organisms. The program element also states that an ultrasonic thickness measurement of the tank bottom surfaces ensures that significant degradation is not occurring.

The staff noted that both the diesel generator fuel oil storage tanks and the diesel generator fuel oil day tanks are made of carbon steel and are exposed to an interior environment of fuel oil. The staff noted that the interior surface of the storage tanks are provided with a protective coating, but the coating is not credited in the LRA for aging mitigation; and the interior surfaces of the day tanks are not coated. The staff also noted that both the fuel oil storage tanks and the day tanks are designed so that the interior of the tanks can be visually inspected. The interior of the fuel oil storage tanks is required by TS to be cleaned every 10 years, and during the cleaning the surface condition of the tank interior is visually examined. The staff noted that except for some additional straining and filtering as fuel oil is pumped from the storage tanks to the day tanks, the interior environments of the storage tanks and the day tanks are identical; and because both tanks are made of carbon steel, aging effects in the storage tanks and the day tanks would be similar. Because aging effects in the day tanks and in the storage tanks are similar, the staff concluded that one-time UT of the bottoms of the day tanks will provide a reasonable indication of whether wall thinning may be occurring in the storage tank bottoms. In addition, the requirement for cleaning of the storage tanks every 10 years and visual inspection of the interior of the storage tanks provides opportunity to detect any degradation in the protective coating that would be an indication of potential degradation in the storage tank steel bottoms. Because degradation of the steel storage tank bottoms would be detected before failure of its intended function could occur, the staff concludes that UT examination of the day tank bottoms provides an acceptable alternative to UT examination of the storage tank bottoms and that Exception 4 to the "detection of aging effects" program element is acceptable.

Based on its review of the exceptions, and resolution of the related RAIs as described above, the staff finds the Fuel Oil Chemistry Program consistent with program elements of GALL AMP XI.M30, with acceptable exceptions, and therefore acceptable.

Operating Experience. The staff reviewed the applicant's OE described in LRA Section B.2.20. The applicant stated that review of plant-specific OE did not reveal a loss of component function or fouling of subject components that contain fuel oil which could be attributed to an inadequacy of the Fuel Oil Chemistry Program. The applicant also stated that fuel oil delivered to the site is sampled and analyzed prior to addition to fuel oil storage tanks and periodically thereafter and that water and sediment is removed, particulates are filtered, and biological activity is controlled.

During the onsite audit, the staff reviewed the applicant's "operating experience" program element for the Fuel Oil Chemistry Program. The staff reviewed selected procedures and completed work packages related to periodic fuel oil chemistry testing and preventive maintenance on components in the fuel oil storage system. The staff noted that the onsite documentation supports the applicant's statements with regard to OE for the Fuel Oil Chemistry Program and that the applicant's OE does not reveal any age related degradation not bounded by industry experience.

Based on this review, the staff finds that (1) the OE for this AMP demonstrates that the applicant's Fuel Oil Chemistry Program is achieving its objective of maintaining fuel oil quality and mitigating potential corrosion of components exposed to fuel oil, and (2) that the applicant is taking appropriate corrective actions through implementation of this program.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.21,and Commitment No. 47 in Table A-1, the applicant provided the UFSAR supplement for the Fuel Oil Chemistry Program. The staff noted that the UFSAR supplement's description for the Fuel Oil Chemistry Program conforms with the recommended UFSAR supplement for this type of program as described in SRP-LR (NUREG-1800, Revision 1). The staff also noted that in Commitment No. 47 of LRA Table A-1, License Renewal Commitments, the applicant committed to ongoing implementation of the Fuel Oil Chemistry Program for aging management of applicable components during the period of extended operation.

Based on this review, the staff finds that the UFSAR supplement summary in LRA Section A.1.2.21 provides an acceptable description of the applicant's Fuel Oil Chemistry Program because it is consistent with the UFSAR supplement summary description in the SRP-LR for the Fuel Oil Chemistry Program.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program as required by 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's Fuel Oil Chemistry Program, including the LRA changes provided in response to RAI B.2.20-1, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. The

staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. LRA Section B.2.21 describes the existing Reactor Vessel Surveillance Program as consistent, with exception, with GALL AMP XI.M31, "Reactor Vessel Surveillance."

The Reactor Vessel Surveillance Program, which manages reduction of fracture toughness for the low-alloy steel RV shell and welds in the beltline region, is a condition-monitoring program developed in response to 10 CFR Part 50 Appendix H, "Reactor Vessel Material Surveillance Program Requirements," and part of the Integrated Surveillance Program (ISP) described in BWRVIP-78, "BWR Integrated Surveillance Program Plan," BWRVIP-86-A, "BWR Vessel and Internals Project, BWR Integrated Surveillance Program Implementation," and BWRVIP-116, "BWR Vessel And Internals Project, Integrated Surveillance Program Implementation For License Renewal." BWRVIP-116 extends the ISP to cover the period of extended operation. The applicant will follow BWRVIP ISP requirements and apply ISP data to SSES, Units 1 and 2. The staff approved the use of the BWRVIP ISP in place of a plant-specific program.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, remained adequate to manage the aging effects for which it is credited.

In LRA Appendix B, AMP B.2.21, the applicant described its AMP to manage irradiation embrittlement of the RPV through testing that monitors RPV beltline material properties. The LRA stated that the RPV surveillance program will follow the requirements of the BWRVIP ISP and will apply the ISP data to the SSES units.

10 CFR Part 50, Appendix H requires that an ISP, which is used as a basis for a facility's RPV surveillance program, be reviewed and approved by the staff. The ISP to be used by the applicant is a program that was developed by the BWRVIP, and the applicant will apply the BWRVIP ISP as the method by which the SSES units will comply with the requirements of 10 CFR Part 50, Appendix H.

The applicant has implemented the BWRVIP ISP based on the BWRVIP-78 report and the BWRVIP-86-A report. These reports are consistent with the GALL AMP XI.M31 for the period of the current licenses. The staff concluded that the BWRVIP ISP in BWRVIP-78 and the BWRVIP-86-A reports is acceptable for BWR licensee implementation provided that all participating licensees use one or more compatible neutron fluence methodologies acceptable to the staff for determining surveillance capsule and RPV neutron fluences. The staff's acceptance of the BWRVIP ISP for the current term at SSES is documented in the staff's SER dated February 6, 2003, which is addressed in SSES License Amendment 208.

In addition, the BWRVIP developed an updated version of the ISP in the BWRVIP-116 report, which provides guidelines for an ISP to monitor neutron irradiation embrittlement of the RPV beltline materials for all U.S. BWR power plants for the license renewal period. The BWRVIP

ISP identifies capsules that must be tested to monitor neutron radiation embrittlement for all licensees participating in the ISP and identifies capsules that are available on a "contingency" basis (deferred capsules). However, no guidance is provided in the BWRVIP-116 for continued use, storage, or testing of deferred capsules. Table 3-3 of the BWRVIP-116 report indicates that both SSES units have deferred capsules.

The applicant stated in LRA AMP B.2.21, and in the UFSAR supplement Section A.1.2.41, "Reactor Vessel Surveillance Program," that the Reactor Vessel Surveillance Program is part of the ISP described in BWRVIP-78, BWRVIP-86-A, and BWRVIP-116 and it will follow the requirements of the BWRVIP ISP. BWRVIP-116-A has not been issued yet. Therefore, following the requirements of the BWRVIP ISP, as stated in LRA AMP B.2.21, may not obligate the applicant to address the additional requirements in the SER on BWRVIP-116 dated March 1, 2006. Hence, the staff issued RAI B.2.21-1, requesting that the applicant make a commitment to address these additional requirements.

By letter dated October 16, 2007, the applicant stated in its response to RAI B.2.21-1 that it would update AMP B.2.21 and UFSAR Section A.1.2.41 to include commitment No.18 to address the additional requirements that are specified in the March 1, 2006, SER. Hence, RAI B.2.21-1 is resolved.

Exception. LRA B.2.21 characterized the SSES RPV surveillance program as consistent with NUREG-1801, Section XI.M31, "Reactor Vessel Surveillance," with an exception from the NUREG-1801 guideline which requires that analyzed capsules be stored once the analysis is complete. The staff does not accept this exception because analyzed specimens may be reconstituted for future use during or beyond the current requested extended period of operation. Hence, the staff issued RAI B.2.21-2, requesting the applicant remove this exception to NUREG-1801. Further, since the BWRVIP-116 did not provide guidelines for storage of deferred capsules, RAI B.2.21-2 also requested the applicant commit to the following:

> If the SSES standby capsule is removed from the RPV without the intent to test it, the capsule will be stored in manner which maintains it in a condition which would permit its future use, including during the period of extended operation, if necessary.

By letter dated October 16, 2007, the applicant made appropriate revisions to LRA AMP B.2.21, LRA UFSAR Section A.1.2.41, and LRA Table A-1, Commitment No. 18, to reflect the elimination of the NUREG-1801 exception and the inclusion of the commitment cited above. Hence, RAI B.2.21-2 is resolved.

On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging due to loss of fracture toughness of the RPV beltline region will be adequately managed by the SSES Reactor Vessel Surveillance Program, 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).

Operating Experience. LRA Section B.2.21 states that there have been capsule evaluations on SSES Units 1 and 2 prior to the BWRVIP ISP. Measured decreases in upper shelf energy were consistently less than RG 1.99 projections. Measured Unit 1 RT_{NDT} increases were slightly greater, within one standard deviation, than the RG 1.99 projections while measured Unit 2 RT_{NDT} increases were less.

The staff confirmed that the above description of the OE regarding SSES's evaluation of its surveillance data from the Reactor Vessel Surveillance Program is correct. The fact that the measured decreases in USE were consistently less than RG 1.99 projections and measured RT_{NDT} increases were within one standard deviation of the RG 1.99 projections indicated that SSES's surveillance data testing results are consistent with industry OE.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.41, and Commitment No. 18 in Table A-1, the applicant provided the UFSAR supplement for the Reactor Vessel Surveillance Program. The staff reviewed this section and determines that the information in the revised UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of the audit and review of the applicant's Reactor Vessel Surveillance Program, the staff determines that those program elements, for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 Buried Piping and Tanks Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.30 describes the new Buried Piping and Tanks Inspection Program as consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with exceptions. This program is used to manage external corrosion of buried piping and tanks by use of external coating where appropriate combined with visual inspections of the external surfaces.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report program. Onsite interviews were also held to confirm these results.

The staff reviewed the exceptions to determine whether the AMP, with the exceptions, will be adequate to manage the aging effects for which the LRA credits it .

Exception 1. The applicant stated an exception to the "scope" program element, stating, in addition to steel (which includes cast iron) piping components and steel tanks, the scope of program includes stainless steel piping components. The GALL AMP only considers steel piping and will be updated to include additional materials in the next revision of GALL. Recent LRA reviews have shown that additional materials should be included in this AMP such as stainless steel, AL6XN specialty steel, titanium alloys, aluminum alloys, and copper alloys. The staff noted that based on the applicant's plant-specific operating experience that uncoated stainless steel buried piping has not experienced degradation. However the applicant has conservatively added the buried stainless steel piping within the scope of this program to ensure that degradation has not occurred. The staff noted that a visual inspection will be performed by the

applicant on the buried stainless steel piping within 10 years prior to entering the period of extended operation. The inspection will be capable of detecting age-related degradation as a result of loss of material, consistent with the GALL recommendations. The American Water Works Association standard for stainless steel piping is AWWA C220, "Stainless Steel Piping." On the basis of its review, the staff finds the applicant has conservatively included stainless steel piping in the scope of this program to be inspected within 10 years prior to entering the period of extended operation and that a visual inspection of the external surface will be capable of detecting loss of material, and therefore this exception is acceptable.

The applicant stated an exception to the "preventive actions" program element, stating the buried fire protection piping components and the buried stainless steel piping components in the Condensate Transfer and Storage System are not provided with any special coatings or wrappings in accordance with plant design specifications and consistent with plant operating experience. The applicant stated in the LRA that buried piping in the Fire Protection System is constructed using cast iron and ductile iron. It is not coated per the plant design specifications. However the staff did not agree with the applicant for not coating this buried pipe, and issued RAI B.2.30-1 in a letter dated June 13, 2008, to investigate this staff concern. The RAI B.2.30-1 stated that the GALL Report has certain requirements for coating buried piping and questioned the applicant's decision not to coat the cast iron and ductile iron fire protection piping. By a letter dated July 14, 2008, the applicant responded to this RAI stating that the NFPA guidance in NFPA-24 only requires protective coatings of ductile iron or cast iron piping when the piping is buried in aggressive soil. The applicant claimed that the soil at SSES is non-aggressive (Chlorides less than 500 ppm, Sulfates less than 1500 ppm, and pH greater than 5.5). The staff does not agree with this response because the definition for non-aggressive in the applicant's response is for steel reinforcing bar in sub surface concrete and is not applicable to buried ductile iron or cast iron piping. In a letter dated November 17, 2008, the applicant revised the response to RAI B.2.30-1. In the revised response, the applicant agreed to conduct an opportunistic inspection of the buried stainless steel and cast iron buried piping prior to entering the period of extended operation. Because this will confirm that there is no loss of material for stainless steel and carbon steel piping, or if loss of material is identified, the applicant will initiate corrective action, the staff finds that this is acceptable.

Exception 2. LRA Section 3.3.4.1.13 states that the Fire Protection System piping will be inspected as part of the Selective Leaching Inspection Program. However, the applicant's Buried Piping and Tanks Inspection Program did not mention this. Therefore, the staff issued RAI B.2.30-2 in a letter dated June 13, 2008, to follow up on this issue. In the applicant's response to the RAI in the letter dated July 14, 2008, the applicant amended the Buried Piping and Tanks Inspection Program to clarify that loss of material due to selective leaching for buried cast iron components is managed by the Selective Leaching Inspection Program. This amendment satisfactorily addresses the staff's concern, and this item is closed.

By letter dated June 13, 2008, in RAI B.2.30-3 the staff asked the applicant if there was any uncoated carbon steel piping in the fire protection system. By letter dated July 14, 2008, the applicant responded that there is no uncoated carbon steel piping in the fire protection system. The staff finds that because there is no uncoated carbon steel piping in the fire protection system, this issue is resolved.

The staff reviewed those portions of the applicant's Buried Piping and Tanks Inspection Program that the applicant claimed consistency with GALL AMP XI.M34 and found they are consistent with this GALL AMP. On the basis of the review, the staff concludes that the applicant's Buried Piping and Tanks Inspection Program provides assurance that either the

aging effect is indeed not occurring, or that the aging effect is occurring very slowly as not to affect the intended function of the component or structure. The staff finds the applicant's Buried Piping and Tanks Inspection Program acceptable because it conforms to the recommended GALL AMP XI.M34, Buried Piping and Tanks Inspection Program is consistent with program elements of GALL AMP XI.M34, with acceptable exceptions, and is therefore acceptable.

Operating Experience. The staff reviewed the applicant's OE described in LRA Section B.2.30. Additionally, the staff reviewed a sample of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In the application, the applicant stated that there is no operating experience with the effectiveness of the program because it is a new program.

The applicant stated that the Buried Piping and Tanks Inspection is a new program for which there is no operating experience and that inspection methods will be consistent with accepted industry practices. For this program and for other new AMPs where the applicant provided no current plant-specific operating experience, the staff issued RAI B.2.1 asking that the applicant commit to provide documentation of plant-specific operating experience for staff review after the program has been implemented, but prior to entering the period of extended operation.

In its letter dated July 8, 2008, the applicant stated that operating experience for new aging management programs described in LRA Appendix B will be gained as these new programs are implemented during the period of extended operation. The applicant stated that results of tests, inspections, and other aging management activities conducted in accordance with these programs will be subject to confirmation and corrective action elements of the SSES 10 CFR 50, Appendix B, Quality Assurance program and that results will be subject to NRC review during regional inspections under existing NRC inspection modules. The applicant stated that these new programs will be implemented prior to, and continue through, the period of extended operation and that operating experience will be gained for these programs as they are implemented. The applicant further stated that test and inspection results that do not meet acceptance criteria for these new programs will be evaluated under the station's corrective action program, which includes requirements for identification of appropriate corrective actions and verification of the effectiveness of corrective actions.

The staff noted that the applicant's statement that inspection methods will be consistent with industry practices is consistent with the "operating experience" program element for GALL AMP XI.M34. The staff also noted that post-approval site inspections provide an opportunity for staff review and assessment of the effectiveness of the applicant's Buried Piping and Tanks Inspection Program after the applicant has developed operating experience with that program. The staff concludes that the corrective action program, based on internal and external plant operating experience, would capture operating experience in the future to support the conclusion that the effects of aging are adequately managed. On this basis, the staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10.

The staff finds this program element acceptable and concludes that a separate commitment is not necessary.

The staff confirmed that the operating experience program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.3, and Commitment No. 26 in Table A-1, the applicant provided the UFSAR Supplement for the Buried Piping and Tanks Inspection Program. The staff reviewed this section and determined that the information in the UFSAR Supplement does provide an adequate summary description of the program consistent with the SRP-LR. The UFSAR Supplement does cite the commitment (Commitment No. 26) to implement the program, and it does mention that the program must be implemented prior to the period of extended operation.

By letter dated June 13, 2008, the staff issued RAIs on the need to coat ductile iron and cast iron piping, the need to mention that ductile iron and cast iron piping are included in the Selective Leaching Inspection Program, and whether or not there is any uncoated carbon steel piping in the fire protection system. By letters dated July 14, 2008, and November 17, 2008, the applicant provided responses to these RAIs that the staff finds to be acceptable.

The staff determines that the UFSAR supplement for this AMP provides an adequate summary description of the program, as described by 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's Buried Piping and Tanks Inspection Program the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed, so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 System Walkdown Program

Summary of Technical Information in the Application. LRA Section B.2.32 describes the existing System Walkdown Program as consistent with GALL AMP XI.M36 "External Surfaces Monitoring" with enhancements to the program elements, "scope of program" and "detection of aging effects."

The applicant's program is a condition monitoring program that manages for aging effects of external surfaces and in some cases, internal surfaces, by observations and surveillance activities for mechanical components in the scope of license renewal. The applicant states that the System Walkdown Program will manage loss of material for metals in indoor/outdoor air and ventilation environments and cracking and/or change in material properties for elastomers and polymers exposed to indoor air or ventilation environments.

By letters dated August 12, 2008, October 21, 2008, and November 11, 2008, the applicant amended its LRA to include additional enhancements and exceptions to the AMP B.2.32, Systems Walkdown Program.

Staff Evaluation. During the review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions and enhancements to determine whether the AMP, with the exceptions and enhancements is adequate to manage the aging effects for

which the LRA credits it. The staff's summary of its onsite review of AMP B.2.32, System Walkdown Program, is documented in the staff's audit report.

In comparing the seven (7) program elements in the applicant's program to those in GALL AMP XI.M36, the staff noted that the program elements in the applicant's AMP claimed to be consistent with GALL were consistent with the corresponding program element criteria recommended in the program elements of GALL AMP XI.M36 with the exception of three (3) program elements: scope of program, detection of aging effects and OE, that the staff felt there was a need for additional clarification and for which RAIs were issued. The "operating experience" program element is discussed separately below.

The applicant states in LRA Section B.2.32 that this AMP will be credited to manage cracking and/or change in material properties for elastomers and polymers that are exposed to indoor air and ventilation. The staff noted that GALL AMP XI.M36 "External Surfaces Monitoring" is only applicable for steel components for loss of material and leakage. Therefore, by letter dated July 10, 2008, the staff issued RAI B.2.32-4 requesting the applicant to justify the basis for crediting the System Walkdown Program to manage cracking and changes to material properties for elastomer and polymer components. The applicant responded to RAI B.2.32-4 by letter dated August 12, 2008. In its response, the applicant amended the LRA to include exceptions and enhancements that were not previously identified in the LRA to address RAI B.2.32-4. The staff determined that the applicant has addressed RAI B.2.32-4.

In AMP B.2.19 the applicant states that paints, coatings, sealants and caulking will be monitored under the Systems Walkdown Program. Upon the staff's review of LRA section B.2.32 and associated plant basis documents, the staff noted that these materials were not included into the scope of program for B.2.32. Therefore by letter dated July 10, 2008, the staff issued RAI B.2.32-3 requesting the applicant clarify whether paints, coatings, sealants and caulking are within the scope of AMP B.2.32 and if so, to clarify the inspection techniques that will be credited to monitor for applicable aging effects. The applicant responded to RAI B.2.32-3, by letter dated August 12, 2008. In its response letter the applicant stated that paints, coatings, sealants and caulking are not credited for preventing or mitigating the effects of aging and do not perform an intended function as part of license renewal. The staff noted that since the applicant does not credit these design features for aging management they are not required to manage the aging effects that may affect paints, coating, sealants and caulking as part of license renewal. However the applicant referred to its response to RAI B.2.19-1, which stated that structural sealants and caulking are inspected as part of the Structural Monitoring Program. The staff confirmed that sealants and caulking are inspected by the Structural Monitoring Program for the Condensate and Refueling Water Storage Tanks. The staff noted that visual inspections of the condition of paints and coatings on the external surfaces of the Condensate and Refueling Water Storage Tanks will be a sign if degradation and corrosion maybe occurring on the underlying material, but paints and coatings are not credited. Based on its review, the staff finds the applicant's response acceptable because (1) the applicant has not credited paints and coatings with preventing and mitigating aging of the underlying materials, and therefore does not require aging management (2) the applicant will perform periodic visual inspections of the external surfaces of the tanks, including paints and coatings, to determine the condition of the underlying metallic material (3) the staff confirmed that sealants and caulking are inspected and monitored by the Structures Monitoring Program.

Exception. The applicant responded to RAI B.2.32-4, by letter dated August 12, 2008. In its response the applicant amended the LRA Section B.2.32 to include an exception to GALL AMP XI.M36. This exception was in regard to the addition of elastomer and polymer components to

the scope of the applicant's program. During its review the staff also noted that the applicant had included stainless steel, copper alloy and aluminized steel into the scope of its program; however, GALL AMP XI.M36 only recommends this program perform visual inspections on carbon steel components. Therefore by letter dated October 17, 2008, the staff issued RAI B.2.32-5 requesting the applicant to justify why the expansion in-scope of materials was not considered an enhancement and to justify the basis for expanding the scope of materials. Also, by letter dated October 17, 2008, the staff issued RAI B.2.32-4R requesting the applicant to clarify why the exception above was not identified as an enhancement to the GALL AMP XI.M36. By letter dated November 11, 2008, the applicant responded to RAI B.2.32-5 by stating that the expansion in the scope of metallic materials will be considered an exception and enhancement to GALL AMP XI.M36. The following exception was based on the applicant's response to the staff's RAI B.2.32-4 and B.2.32-5:

> *Scope of Program, Parameters Monitored/Inspected, Detection of Aging Effects, Monitoring and Trending*
>
> Elastomers and polymers are included within the scope of the Systems Walkdown Program. The program is credited with managing cracking and change in material properties for elastomers and polymers exposed to indoor air or ventilation environments.
>
> Copper alloy and stainless steel are included within the scope of the System Walkdown Program. The program is credited with managing loss of material for copper alloy and stainless steel exposed to indoor air, outdoor air or ventilation environments.

The applicant responded to RAI B.2.32-4R and RAI B.2.32-5, by letter dated November 11, 2008. In its response to RAI B.2.32-4R the applicant stated that the expansion in the scope of materials for this program is considered an exception and enhancement. The staff's evaluation of this exception and enhancement were performed separately and are documented in this section of the SER. The staff noted that the applicant has committed, by Commitment No. 28 as amended by letter dated November 11, 2008, to enhance its program prior to the period of extended operation to generate a routine activity to supplement the current existing plant program to include a supplemental physical manipulation and/or prodding to inspect elastomer and polymer components. The applicant stated in response to RAI B.2.32-4R that visual inspections of elastomers and polymers will determine if such things as chalking, cracking, crazing, discoloration and any physical distortion that may be occurring. The staff noted that for the supplemental physical manipulation the applicant will identify hardening, lack of resiliency, surface film or residue and unusual odors. The staff further noted that any signs of the degradation identified by the visual inspection or physical manipulation will be evaluated. The staff noted that the physical manipulation will aid the visual inspection in detecting age-related degradation because changes in material properties and cracking can be detected during manipulation of elastomeric and polymeric components by the relative inflexibility of the component, or by the failure of the component to return to its previous shape or configuration. On the basis of its review, the staff finds that the applicant will be capable of managing the effects of aging for elastomers and polymers because the applicant (1) is crediting a visual examination of elastomer and polymers and an inspection technique that includes physical manipulation and/prodding of the components, which are capable of detecting the aging effects of cracking and/or change in material properties and (2) any signs of degradation will be evaluated by the applicant and addressed as part of their corrective actions program.

In its response to RAI B.2.32-5 the applicant stated that for the aging effect and aging mechanisms of concern, which include loss of material due to pitting, crevice and galvanic corrosion, for copper alloy and stainless steel are similar to carbon steel, such that a visual inspection will be effective in identifying loss of material. The applicant stated that aluminized steel is considered to be equivalent to steel because the aluminum coating is not credited. The staff determined that since the applicant does not credit the aluminum coating, aluminized steel is equivalent to steel and does not need to be included in the expansion in the scope of materials. The staff noted that metallic components, including copper alloy and stainless steel, would exhibit indications of loss of material on the surface similar to steel and a visual inspection will be capable of detecting age related degradation. The applicant further stated that the parameters monitored by the visual inspection will include: corrosion, wastage of material, leakage to and from external surfaces, worn/flaking/oxide-coated surfaces, corrosion stains and coating degradation. Furthermore, any signs of degradation that is present will be evaluated to determine if the components are acceptable for continued operation. On the basis of its review, the staff finds the applicant's response acceptable because (1) the applicant will be performing visual inspections that are capable of detecting loss of material in metallic components as they display indications of degradation similar to steel, for which GALL AMP XI.M36 was intended and (2) any signs of degradation will evaluated.

On the basis of its review of the LRA and the applicant's responses to RAI B.2.32-4, RAI B.2.32-4R and RAI B.2.32-5, the staff finds the applicant's exception acceptable because (1) the applicant will perform visual inspections during system walkdowns that will be effective in identifying loss of material in other metallic components which exhibit indications of degradation similar to steel, (2) the applicant will supplement the visual inspection with a physical manipulation and/or prodding, which are adequate techniques to detect change in material properties and cracking in elastomers and polymers (3) and any degradation will be evaluated to ensure these metallic and non-metallic components are acceptable for continued operation.

Enhancement 1. In LRA Section B.2.32 the applicant states that the program element "scope of program" for the System Walkdown Program must be enhanced in order to be consistent with GALL XI.M36, "External Surfaces Monitoring." By letter dated November 11, 2008, the applicant amended the LRA to include additional information to this enhancement. The applicant's enhancement to the scope of program is as follows:

> *Scope of Program*
>
> The governing procedure for the System Walkdown Program must be revised to add the listing of systems crediting the program for license renewal, and to explicitly include other metals, copper alloy and stainless steel. A routine activity to supplement the existing plant program must be generated to inspect elastomers and polymers.

In the program element "scope of program" for GALL XI.M36 "External Surfaces Monitoring," it's states that external surfaces of in-scope components are to be visually inspected. The additional information in this enhancement, in regards to the additional metallic components and elastomers, is evaluated by the staff in Exception #1 and Enhancement #4 in this section of the SER. The staff reviewed LRA Section B.2.32 and finds the applicant's enhancement acceptable because the applicant's procedure will be updated to include all systems that have credited this program for aging management based on the recommendations of GALL XI.M36.

On the basis of its review, as described above, the staff concludes that this enhancement is acceptable.

Enhancement 2. In LRA Section B.2.32 the applicant states that the program element "detection of aging effects" for the System Walkdown Program must be enhanced in order to be consistent with GALL XI.M36. By letter dated October 21, 2008, the applicant amended its LRA based on a License Renewal Regional Inspection, and in this amendment the applicant provided additional details to this enhancement. The applicant's enhancement to the detection of aging effects is as follows:

> *Detection of Aging Effects*
>
> All of the systems to be added to the procedure contain mechanical components whose external surfaces require aging management during the period of extended operation. It may be determined by engineering evaluation that these components do not require monitoring every two weeks, and the basis for a different walkdown frequency may be documented on the appropriate procedure form.
>
> The governing procedure for the System Walkdown Program must be enhanced to address the license renewal requirement for opportunistic inspections of normally inaccessible components (e.g., those that are insulated), and those that are accessible only during refueling outages.
>
> For underground vaults, an initial sample of at least one vault/pit/manhole from each grouping of components with identical material and environment combinations will be inspected prior to entering the period of extended operation. A representative sample of the entire population will be inspected within the first 6 years of the period of extended operation. Results of the inspection activities that require further engineering evaluation/resolution (e.g., sample expansion and inspection frequency changes if degradation is detected), if any, will be evaluated using the corrective action process.

Based on its review, the staff determined additional information was needed to complete its review that relates to the systems that will be added to the scope of the AMP B.2.32, the current frequency of inspections, and the basis for changing the frequency. Therefore, by letter dated July 10, 2008, the staff issued RAI B.2.32-2 requesting the applicant to identify the systems that are within the scope of the AMP B.2.32 that are subject to the enhancements, to clarify the current frequency of system walkdowns for different plant systems that are within the scope of AMP B.2.32, and to provide the basis for changing the frequency of system walkdowns and clarify the process used for changing these frequencies. The applicant responded to RAI B.2.32-2, by letter dated August 12, 2008. The applicant provided a listing of the systems that would be affected by this enhancement as requested by the staff. The applicant also provided the frequency of walkdowns that are applicable to the scope of systems managed by this program. The staff noted that the frequencies being utilized by the applicant are consistent with those recommendations provided in GALL AMP XI.M36, which are walkdowns that exceed once per refueling cycle for accessible locations, for locations inaccessible during normal plant operation inspections are performed during the RFO, and for those locations that are inaccessible during RFOs and normal plant operation inspections will be performed opportunistically. As stated in the "detection of aging effects" program element in the GALL Report, the inspection frequency may be adjusted as needed based on the plant-specific

inspection results and industry experience. The applicant's proposal to adjust the inspection frequency is consistent with the recommendations in the GALL Report, and is subject to an engineering evaluation, approval by engineering supervision and is subject to a 10 CFR 50.59 review to determine if prior NRC approval is required for any frequency change. The applicant amended the LRA by letter dated October 21, 2008, provided details on inspections that will be performed before and after the period of extended operation on those normally inaccessible components that require opportunistic inspections, specifically samples of underground vaults. The staff noted for these normally inaccessible locations, the applicant has committed to inspect an initial sample before the period of extended operation and again within 6 years after the start of the period of extended operation. The staff further noted that the applicant's approach is conservative because it requires the inspection within 6 years after entering the period of extended operation compared to an opportunistic inspection that may potentially exceed 6 years. Based on its review, the staff finds the applicant's response and enhancement acceptable because (1) the applicant's inspection frequency is consistent with the recommendations provided in GALL AMP XI.M36, (2) the applicant's ability to change the inspection frequency of walkdowns is subject to a 10 CFR 50.59 review and (3) for underground vaults the applicant's commitment to perform inspections in a specified time frame that is conservative compared to a strictly opportunistic inspection.

On the basis of its review as described above, the staff concludes the applicant's enhancement when implemented prior to the period of extended operation is acceptable.

Enhancement 3. By letter dated October 21, 2008, the applicant amended the LRA to provide an additional enhancement. The applicant's enhancement to the detection of aging effects program element is as follows:

> *Detection of Aging Effects*
>
> Also, within the 10 year period prior to the period of extended operation a visual inspection and ultrasonic inspection of external surfaces of piping passing into structures through penetrations (underground piping) will be performed, for those penetrations with a history of leakage. These inspections will be focused on penetrations that are leaking at the time and will include a representative sample of each material, environment combination from those piping systems within the scope of license renewal (which includes those for the RHRSW, ESW, and Fire Protection systems) that enter structures below grade.

The staff noted that the applicant has committed to perform a visual inspection of external surfaces of piping passing into structures through penetrations (underground piping) and in addition the applicant will conservatively perform an ultrasonic inspection to identify degradation. Furthermore, the applicant committed to perform these inspections prior to entering the period of extended operation to ensure detection of degradation prior to component intended function being lost. The staff noted the applicant's commitment, captured in Commitment No. 28, will require inspections of these areas prior to the period of extended operation to ensure that degradation, if any, is detected and corrected by the corrective actions program prior to entering the period of extended operation.

On the basis of its review, as described above and the applicant's enhancements when implemented prior to the period of extended operation will make the applicant's Systems Walkdown Program consistent with the recommendations provided by GALL AMP XI.M36. On the basis of its review, the staff finds the applicant's enhancement acceptable because (1) the

applicant will be performing a visual inspection of the external surfaces of piping that enter structures below grade, which is consistent with the recommendations in GALL AMP XI.M36 and (2) the applicant will conservatively perform an ultrasonic inspection in addition to the visual inspection to assist in the detection of any degradation in those penetrations that are leaking and with a history of leakage.

Enhancement 4. The applicant responded to RAI B.2.32-4, by letter dated August 12, 2008. In its response the applicant amended the LRA Section B.2.32 to include the following enhancement, and subsequently amended by letter dated November 11, 2008, to provide additional details:

> *Parameters Monitored/Inspected*
>
> A routine activity must be generated, and based at least in part on EPRI 1007933, "Aging Assessment Field Guide", to inspect elastomers and polymers for cracking and/or change in material properties. Evidence of surface degradation, such as cracking, or discoloration, as well as physical manipulation and/or prodding, will be used as measures of material condition.

The staff noted that the applicant has expanded the scope of its System Walkdown Program to include elastomer and polymer components. The staff further noted that a visual inspection alone would not have been capable of detecting aging effects such as cracking and/or change in material properties for elastomers and polymers. Based on the applicant's amendment to include this enhancement the staff noted that the applicant will not only utilize a visual inspection for evidence of degradation, noticeable cracking or discoloration, but the applicant will be supplementing the visual inspection with an appropriate physical manipulation and/or prodding of the component. However, the staff felt that additional information was needed; therefore, by letter dated October 17, 2008, the staff issued follow-up RAI B.2.32-4R Part B requesting the applicant to clarify the acceptance criteria for the supplemental physical manipulation and/or prodding of polymers and elastomers. By letter dated November 11, 2008, the applicant responded to RAI B.2.32-4R by stating that the visual inspection of the elastomers will determine if such things as chalking, cracking, crazing, discoloration and any physical distortion is occurring. The staff noted that for the supplemental physical manipulation the applicant will identify hardening, lack of resiliency, surface film or residue and unusual odors. The staff further noted that any signs of the degradation identified by the visual inspection or physical manipulation will be evaluated. The staff noted that the physical manipulation will aid the visual inspection in detecting age-related degradation because changes in material properties and cracking can be detected during manipulation of elastomeric and polymeric components by the relative inflexibility of the component, or by the failure of the component to return to its previous shape or configuration. On the basis of its review, the staff finds that the applicant will be capable of managing the effects of aging for elastomers and polymers because the applicant (1) is crediting a visual examination of elastomer and polymers and an inspection technique that includes physical manipulation and/prodding of the components, which is capable of detecting the aging effects of cracking and/or change in material properties and (2) any signs of degradation will be evaluated by the applicant and addressed as part of its corrective actions program.

On the basis of its review, the staff finds the applicant's enhancement acceptable because the applicant will perform visual inspections and a physical manipulation during system walkdowns that will be effective in identifying change in material properties and cracking for elastomer and

polymer components and any degradation will be evaluated to ensure these components are acceptable for continued operation.

Enhancement 5. The applicant responded to RAI B.2.32-4 by letter dated August 12, 2008. In its response the applicant amended the LRA Section B.2.32 to include the following enhancement, which was supplemented by a letter dated November 11, 2008, to indicate the specific routine activity:

> *Detection of Aging Effects*
>
> The routine activity to inspect elastomers and polymers, to include physical manipulation and/or prodding, will be based on inspection of a representative sample of components. The sample will be determined by engineering evaluation with a focus on components considered to be most susceptible to aging, such as due to their time in service, the severity of conditions during normal plant operation, and any pertinent design margins.

The staff noted that the applicant is selecting a representative sample of elastomer and polymer components. The applicant stated that this representative sample will be based on an engineering evaluation which takes into consideration which components may be more susceptible to aging. The staff further noted that such conditions as the amount of time the component has been in service, the severity of the conditions and environments that the component is exposed to during normal plant operation and other relevant design margins that may be applicable are factored in as part of the applicant's engineering evaluation to select components for the routine activity to inspect elastomers and polymers.

On the basis of its review, the staff finds that the applicant's enhancement acceptable because (1) the applicant's representative samples of elastomer and polymer components for inspection will be based on selecting those components that are more susceptible and likely to experience age-related degradation and (2) the applicant will supplement its visual inspection with a physical manipulation and/or prodding which will be capable of detecting cracking and/or change in material properties in elastomers and polymers as discussed in Enhancement No. 4.

Operating Experience. The staff also reviewed the applicant's OE described in the applicant's license renewal basis document for the System Walkdown Program. The staff noted during its review of the license renewal plant basis documents for this program, which the applicant reviewed its plant OE action requests and condition reports for the most recent five-year period. From the applicant's review of its database, it was revealed that leakage, damage, and degradation are routinely identified by this program. The staff noted that subsequent to identifying an issue with this program, corrective actions were taken in a timely manner, and a loss of pressure boundary integrity did not occur due to aging effects that are within the scope of this program. However, the staff felt that additional information was needed to complete its review; therefore, by letter dated July 10, 2008, the staff issued RAI B.2.32-1 requesting the applicant to identify the plant systems within the scope of this program that have had problems with age-related degradation and to also identify the specific age-related degradation that was occurring in each instance. The staff further asked the applicant to clarify if the age-related degradation has had any impact on the program's ability to manage aging and if the program will need to be augmented or enhanced to ensure adequate aging management of these systems. Finally, the staff asked the applicant to identify the corrective actions that were taken to correct these issues associated with the problems in the plant systems in the scope of this program.

The applicant responded to RAI B.2.32-1, by letter dated August 12, 2008. In this letter, the applicant stated that as part of the preparation of the LRA, a plant-specific search of Action Requests and Condition Reports was performed of the most recent 5-year period for OE. The applicant provided several examples of OE and the corrective actions that were taken in response to the action request or condition report. The staff noted that one of the examples provided by the applicant indicated the Instrument Air piping had a crack downstream of an isolation valve. The applicant took corrective actions and replaced the cracked section of pipe. Another example provided by the applicant indicated that the enamel/wrap coating that normally protects the piping for the Circulating Water System was severely degraded on the piping that extends above the ground near the base of the cooling towers. The applicant noted that the portions of the pipe that had been exposed due to the coating degradation were corroded. The staff noted that based on this discovery of the degraded coating and corroded piping the applicant initiated corrective actions to take UT measurements of the piping to ensure that there was sufficient and proper wall thickness before the piping was re-coated. As an added measure, the applicant excavated the buried portions of the corroded piping to ensure that the coating was intact and that wall thinning and corrosion was not occurring in the buried portion of this piping during the RFO that followed the initial discovery. Based on the staff's review of the applicant's response and the OE that was provided, the staff finds the applicant's response acceptable because the applicant's program was capable of detecting degradation bounded by industry experience and then initiated corrective actions to resolve the discovered degradation.

The staff confirmed that the "operating" experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds the program element acceptable.

UFSAR Supplement. The staff reviewed the UFSAR Supplement summary description that was provided in LRA Section A.1.2.47, and Commitment No. 28 in Table A-1, for the System Walkdown Program. The staff verified that, in LRA Commitment No. 28 of UFSAR Supplement Table A-1, the applicant committed to enhancing its program prior to the period of extended operation. By letters dated August 12, 2008, October 21, 2008, and November 11, 2008, the applicant amended the LRA to include additional enhancements to AMP B.2.32. The staff confirmed the applicant amended LRA Section A.1.2.47 and Commitment No. 28 to include a brief description of these enhancements and has committed to implement these enhancements prior to the period of extended operation. The staff also verified that the applicant has placed this commitment in UFSAR Supplement summary description A.1.2.47 for the System Walkdown Program.

Based on this review, the staff finds that UFSAR Supplement Section A.1.2.47 provides an acceptable UFSAR Supplement summary description of the System Walkdown Program because it is consistent with those UFSAR Supplement summary descriptions in the SRP-LR and because the summary description includes the bases for determining that aging effects will be managed. The staff determines that the UFSAR supplement for this AMP provides an adequate summary description of the program, as described by 10 CFR 54.21(d).

Conclusion. On the basis of the audit and review of the applicant's System Walkdown Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that they will be implemented through Commitment No. 28 prior to the period of extended

operation. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.15 Lubricating Oil Analysis Program

Summary of Technical Information in the Application. LRA Section B.2.33 of the LRA describes the existing program, "Lubricating Oil Analysis Program." as consistent with the GALL AMP XI.M39, "Lubricating Oil Analysis Program" with enhancement and exceptions. The LRA states this program is used to mitigate damage in components exposed to lubricating oil due to loss of material and reduction of heat transfer due to fouling. The applicant stated that the program manages the aging effects through monitoring that is consistent with manufacturer's recommendations and standards for lubricating oil from the ASTM. In addition, this program is supplemented with the Lubricating Oil Inspection, a one-time inspection program to verify its effectiveness.

Staff Evaluation. The staff's summary of its onsite review of AMP B.2.33, Lubricating Oil Analysis Program, is documented in staff's audit report. For its onsite review, the staff reviewed and compared the program elements of B.2.33 Lubricating Oil Analysis Program with its corresponding elements of GALL AMP XI.M39, "Lubricating Oil Analysis Program."

In comparing the seven (7) program elements in the applicant's program to those in GALL AMP XI.M39, the staff noted that the program elements in the applicant's AMP claimed to be consistent with the GALL Report were consistent with the corresponding program element criteria recommended in the program elements of GALL AMP XI.M39 with the exception of those enhancements and exceptions taken by the applicant that the staff determined there was a need for additional clarification and for which RAIs were issued. The staff reviewed the exceptions and enhancement, to determine whether the AMP with the exceptions and enhancement, is adequate to manage the aging effects for which the LRA credits it. The operating experience program element is discussed separately below.

Exception 1. The Lubricating Oil Analysis Program includes two exceptions to the parameters monitored or inspection program element. The first exception is that the program does not perform a particle count on the Emergency Diesel Generator or RHR System pump motor oil samples. Instead, the applicant performs direct read ferrography as stated in LRA section B.2.33. The staff noted that direct read ferrography only measures ferrous particles whereas particle counters measures both ferrous and non-ferrous particles. Thus, aging effects due to non-ferrous particles may not be accounted for by ferrography. By letter dated July 10, 2008, the staff issued RAI B.2.33-1 in which the staff requested the applicant to justify why "direct read ferrography" is an acceptable alternative to performance of periodic particular content counting. By letter dated August 12, 2008, the applicant responded to RAI B.2.33-1, in which the applicant stated that it performs a direct read ferrography on the diesel lube oil rather than particle counting because of the way in which particle counting performs the test. The applicant explained that the particle counters utilize optical devices that pass light through the lube oil sample in order to count the particles. The staff noted that diesel lube oil is dark in color, and the use of a particle counter on dark lube oils is difficult unless the sample lube oil is diluted in order to allow more light to pass through the sample oil. The applicant stated that dilution of the sample lube oil would create concerns if the diluents contain any contamination that may skew the results from the particle counting. The staff further noted that the method of direct read

ferrography primarily measures the number of ferrous particles per milliliter of fluid, which is normally due to mechanical wear of the system. The staff further noted that the applicant stated it utilizes a spectrochemical testing which is capable of measuring up to twenty-one different metals less than 10-microns in size. The staff noted that the intent of the recommendation of the GALL AMP XI.M39 to perform particle counting was to reveal abnormal wear rates or excessive corrosion. The staff finds that the applicant's use of direct read ferrography and spectrochemical testing will be capable of revealing abnormal wear rates, excessive corrosion, and detect changing trends in wear debris and contamination. On the basis of its review, the staff finds the applicant's response acceptable as described above.

On the basis of its review, the staff finds the applicant's exception acceptable because with the use of direct read ferrography and spectrochemical testing on dark diesel lubricating oil the applicant will be capable of detecting abnormal wear rates, excessive corrosion and detect changing trends in wear debris and contamination, which is consistent with the intent of the particle counting test that is recommended by GALL AMP XI.M39.

Exception 2. The second exception to this program is it does not determine the flash point for the HPCI, RCIC, or RHR motor oil samples. Instead, the applicant performs direct read ferrography, viscosity, total acid number, water content and metals content as stated in LRA section B.2.33. The staff reviewed this exception and onsite documents for this program. The staff noted that the tests that will be performed in lieu of the flash point testing are acceptable alternatives that would allow the applicant to track the level of contaminants in the oil systems. The staff noted that the intent of the GALL AMP XI.M39 is to maintain the oil systems contaminants within acceptable limits, which the applicant will be capable of doing by performing a direct read ferrography, viscosity, total acid number, water content and metals content test. The staff determined that the tests the applicant will be performing are consistent with the intent of GALL AMP XI.M39 and on this basis; the staff finds this exception acceptable.

Enhancement. The Lubricating Oil Analysis Program includes an enhancement to the scope of the program element. The applicant stated that the program will be enhanced to sample the lubricating oil from the Control Structure Chiller when the oil is changed.

In addition, the applicant further stated that a particle count and a check for water will be performed on the drained oil from the Control Structure Chiller.

As a result of the applicant's response to RAI B.2.25-1, in a letter dated August 12, 2008, the applicant amended LRA Section B.2.33 and Commitment No. 48 so the program will be enhanced to sample the lubricating oil from the Reactor Building Chiller when the oil is changed. In addition, a particle count and a check for water will be performed on the drained oil from the Reactor Building Chiller. The staff noted that the scope of program element of GALL XI.M39 states that on a periodic basis, this program samples lubricating oil from plant components subject to AMR. Upon review of the site documents and the LRA, the staff determines the enhancement is consistent with scope of GALL XI.M39. On this basis, the staff determines this enhancement is acceptable, for the Reactor Building Chiller and Control Structure Chiller.

Operating Experience. The staff also reviewed the operating experience described in LRA Section B.2.33. The applicant indicated that review of SSES operating experience did not reveal a loss of component intended function for components exposed to lubricating oil from inadequacy of the Lubricating Oil Analysis Program. In addition, the LRA stated that abnormal lubricating oil conditions are promptly identified, evaluated, and corrected. The staff reviewed

the operating experience identified in the GALL XI.M39 and noted that it states that no instances of component failures from lubricating oil contamination have been identified as well. In addition, the staff reviewed the onsite operating experience data and condition reports and did not find any reports of component failures due to lubricating oil contamination. On this basis, the staff finds the operating experience data acceptable.

The staff confirmed that the operating experience program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.28, and Commitment No. 48 in Table A-1, the applicant provided the UFSAR Supplement summarizing the Lubricating Oil Analysis Program. The staff reviewed the section of the UFSAR Supplement and determines that it is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff reviewed the UFSAR Supplement summary description that was provided in LRA Section A.1.2.28 for the Lubricating Oil Analysis Program. The staff noted that in its response to RAI B.2.25-1 and the associated amendments, the applicant did not amend LRA Section A.1.2.28 to include the Reactor Building Chiller. The staff confirmed that by letter dated September 26, 2008, the applicant amended LRA Section A.1.2.28 to include the Reactor Building Chiller. The staff verified that, in LRA Commitment No. 48 of UFSAR Supplement Table A-1, the applicant includes a brief description of the enhancement and committed to enhancing the program to include sampling from the Reactor Building Chiller and the Control Structure Chiller and have the lubricating oils tested for water and for particle count and implementing these enhancements prior to the period of extended operation. The staff also verified that the applicant has placed this commitment on UFSAR Supplement summary description A.1.2.28 for the Lubricating Oil Analysis Program.

Based on this review, the staff finds that UFSAR Supplement Section A.1.2.28 provides an acceptable UFSAR Supplement summary description of the Lubricating Oil Analysis Program because it is consistent with those UFSAR Supplement summary descriptions in the SRP-LR and because the summary description includes the bases for determining that aging effects will be managed. Therefore, the staff concludes that the UFSAR supplement for this AMP provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Lubricating Oil Analysis Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff reviewed the enhancement and confirmed that its implementation through Commitment No. 48 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. In addition, the staff reviewed the applicant's responses to the staff's RAI and its evaluation is documented above. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 Masonry Wall Program

Summary of Technical Information in the Application. LRA Section B.2.38 describes the existing Masonry Wall Program as consistent, with an enhancement, with the GALL AMP XI.S5, "Masonry Wall Program." This program will manage aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operations.

The applicant stated that the program includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included components are the 10 CFR 50.48 required masonry walls, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components.

The applicant further stated that the Masonry Wall Program is implemented as part of the Structures Monitoring Program. Masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine whether the AMP, with the enhancement, is adequate to manage the aging effects for which it is credited in the LRA.

The staff interviewed the applicant's technical staff and reviewed the associated bases documents for the AMP B.2.38 "Masonry Wall Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.S5.

The staff noted that the Masonry Wall Program includes the guidance and lessons learned from Office of Inspection and Enforcement Bulletin 80-11 (Masonry Wall Design, U.S. Nuclear Regulatory Commission, May 8, 1980) and IN 87-67 (Lesson Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11, U.S. Nuclear Regulatory Commission, December 31, 1987), During the audit and review, the staff asked the applicant for the visual examination frequency for the program and its technical basis. In its response, the applicant stated that the inspection is implemented by the Structures Monitoring Program and consists of visual inspection for cracking in joints, deterioration of penetrations, missing or broken blocks, missing mortar, and general mechanical soundness of steel supports. The applicant also stated that visual inspections are conducted at least every five years to ensure no loss of intended function between inspections. Based upon its review, the staff finds the applicant's Masonry Wall Program, with the enhancement (Commitment No. 33) as described below, consistent with the program elements of GALL AMP XI.S5, "Masonry Wall Program," and therefore acceptable.

The staff reviewed the enhancement to determine whether the AMP, with the enhancement, is adequate to manage the aging effects for which it is credited in the LRA.

Enhancement. LRA Section B.2.38 states an enhancement to the "acceptance criteria" program element of the Structures Monitoring Program procedure to specify that for each masonry wall, the extent of observed masonry cracking and/or degradation of steel edge supports/bracing are evaluated to ensure that the current evaluation basis is still valid.

The staff reviewed the applicant's Masonry Wall Program, the Structures Monitoring Program, and their AERMs under the acceptance criteria program element of the Structures Monitoring Program. The staff noted that visual examination of masonry walls is performed to identify indications of cracking resulting from overstress due to applied loads, shrinkage, temperature effects, or differential movement. Potential design non-conforming conditions identified during the course of an inspection are noted and a condition report is initiated. Corrective actions are taken if the extent of cracking and steel degradation is sufficient to invalidate the evaluation basis.

The responsible engineer identifies problems with structural performance, initiates structural deficiency reports, and recommends corrective action. Acceptance criteria are established such that corrective actions are initiated prior to loss of function. The staff found this enhancement acceptable because when the enhancement is implemented, AMP B.2.38, "Masonry Wall Program," will be consistent with the GALL AMP XI.S5 and provide additional assurance that the effects of aging will be adequately managed.

Operating Experience. The staff reviewed the applicant's OE described in LRA Section B.2.38, and "Operation Experience Review Report (Masonry Wall's section)," and interviewed the applicant's technical staff to confirm that the plant-specific OE has been reviewed by the applicant and was evaluated as intended in the GALL Report. During its audit, the staff found some minor indications that did not affect the structural integrity of any of the structures reviewed. Furthermore, the staff confirmed that the applicant had addressed OE identified after the issuance of the GALL Report. The staff finds that the applicant's Masonry Wall Program, with the corrective actions and enhancements discussed in the LRA, has been effective in identifying, monitoring, and correcting the aging effects of masonry walls. The staff also confirmed that plant-specific OE did not reveal any degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.31 and Commitment No. 33 in Table A-1, "Masonry Wall Program," the applicant provided the UFSAR supplement for the Masonry Wall Program. The staff reviewed this section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Masonry Wall Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. 33 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.17 Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.39 describes the existing Structures Monitoring Program as consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program." In the LRA, the applicant stated that the program will manage aging effects such that loss of material, cracking, change of material properties, and loss of form are detected by visual inspection prior to the loss of the structure's or component's intended function(s). The applicant also stated that the program also implements the Masonry Wall Program and the RG 1.127 Water Control Structures Inspection.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements (Commitment No. 34) to determine whether the AMP, with the enhancements, is adequate to manage the aging effects for which it is credited in the LRA.

During its audit, the staff reviewed the applicant's onsite documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL Report. The staff interviewed the applicant's technical staff and reviewed the documents related to the Structures Monitoring Program, including the license renewal program evaluation report in which the applicant assessed whether the program elements are consistent with GALL AMP XI.S6.

Enhancement 1. LRA Section B.2.39 states an enhancement to the "scope of program" program element in that the Structures Monitoring Program procedure will be enhanced to include additional structures requiring aging management and "structural component" for inspection includes each of the component types identified as requiring aging management.

The staff reviewed the applicant's Structures Monitoring Program, and its AERMs under the scope of the Structures Monitoring Program. The staff noted that the Structures Monitoring Program satisfies the monitoring requirements for plant structures that are within the scope of the NRC Maintenance Rule (10 CFR 50.65). SSES structures and components that are within the scope of license renewal monitored by the Structures Monitoring Program include the following:

- Primary Containment
- Reactor Building
- Circulating Water Pumphouse and Water Treatment Building
- Control Structure
- Diesel Generator 'A, B, C & D' Building
- Diesel Generator 'E' Building
- Turbine Building
- Engineered Safeguards Service Water (ESSW) Pumphouse
- Spray Pond (includes Emergency Spillway and earthen embankment)
- Clarified Water Storage Tank Foundation
- Condensate Storage Tank Foundation and Retention Basin
- Diesel Generator Fuel Oil Storage Tanks 'A, B, C, D & E' Foundation and Vault

- Refueling Water Storage Tank Foundation
- Station Blackout (SBO) component foundations and structures in the yard (Startup Transformers T-10 and T-20 and associated disconnect switches, ESS Transformers)
- Cooling Tower Basins (Units 1 and 2)
- Duct banks, manholes, valve vaults (includes Spray Pond Valve Vault), instrument pits, and piping trenches (structural component groups not identified as structure/building)
- T-10 230kV Switchyard SBO component foundations and structures (located outside security fence)
- 230kV Switchyard SBO component foundations and structures (located outside security fence)
- 500kV Switchyard SBO component foundations and structures (located outside security fence)

The staff found this enhancement acceptable because when the enhancement is implemented, AMP B.2.39, "Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2. LRA Section B.2.39 states an enhancement to the "parameters monitored or inspected" program element in that the Structures Monitoring Program and excavation procedure will be enhanced to specify that, if the below grade structural wall or component become accessible through excavation, the responsible engineer will inspect the exposed surfaces for age-related degradation. The Structures Monitoring Program procedure will also be enhanced to specify that the responsible engineer shall review the site ground and raw water chemistry data to validate that the below-grade environment remains non-aggressive during the period of extended operations.

The staff reviewed the applicant's Structures Monitoring Program, and its AERMs under the parameters monitored or inspected program element of the Structures Monitoring Program. The staff noted that the chemical analysis of groundwater at WW-2 is non-aggressive, where pH > 5.5, Chloride < 500ppm, Sulfate < 1500ppm, as demonstrated in 2006: pH 6.11; Chloride 23.1 ppm; Sulfate 43.2 ppm and in 2007: pH 6.13; Chloride 40.4 ppm; Sulfate 54.6 ppm. The staff also noted that the Structures Monitoring Program incorporates provisions for increased monitoring described in RG 1.160. This includes clarifications for monitoring under Paragraph (a)(1) of 10 CFR 50.65, including additional degradation-specific condition monitoring and increased frequency of assessments until ongoing corrective actions are complete and functional performance is assured. ACI 201.1R-68, "Guide for Making a Condition Survey of Concrete in Service" is used as a source by the applicant for observing concrete deterioration and surface conditions. The staff further noted that the applicant's assessments are performed in accordance with ANSI/ASCE 11-90, Guideline for Structural Condition Assessments of Existing Buildings, and consider the following:

- Function - Component design features, design basis, operational and maintenance history.
- Existing degradation conditions - Locations, extent, rates.
- Degradation effects upon structural or component function - Structural safety, containment, personnel safety, and protection of equipment. SSES does not employ a

de-watering system in any of the site structures for control of settlement. If a below grade structural wall or structural component becomes accessible through excavation, a follow-up action is initiated for the responsible engineer to inspect the exposed.

The staff found this enhancement acceptable because when the enhancement is implemented, AMP B.2.39, "Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3. LRA Section B.2.39 states an enhancement to the "parameters monitored or inspected" and the "acceptance criteria" program elements of the Structures Monitoring Program in that the procedure will be enhanced to include a degradation mechanism for elastomers and an earthen embankment inspection.

The staff reviewed the applicant's Structures Monitoring Program, and its AERMs under the parameters monitored or inspected, and acceptance criteria program elements of the Structures Monitoring Program. The staff found that the additional structures that require monitoring for license renewal are appropriately included in the Structural Monitoring program. The staff also found the addition of inspection and acceptance criteria for elastomers and earthen embankment inspection to the Structural Monitoring program acceptable because when the enhancement is implemented, AMP B.2.39, "Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 4. LRA Section B.2.39 states an enhancement to the "scope of program" and "parameters monitored or inspected" program elements of the Structures Monitoring Program in that the procedure will be enhanced to include RG 1.127 inspection elements for water control structures.

The staff reviewed the applicant's Structures Monitoring Program, and its AERMs under the scope of program and the parameters monitored or inspected program elements of the Structures Monitoring Program. The staff finds that the applicant omitted the acceptance criteria program element enhancement for Water Control Structures, which should also have been included as part of this enhancement. Therefore, RAI B.2.39-1 was issued. In the letter dated July 8, 2008, the applicant indicated that the LRA Section B.2.39, Structures Monitoring program, is amended to include the Acceptance Criteria for RG 1.127, Water Control Structures Inspection. The staff reviewed the applicant's enhancement described above and its response to the RAI and found them acceptable, because when the enhancement is implemented, AMP B.2.39, "Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 5. LRA Section B.2.39 states an enhancement to the "acceptance criteria" program element of, the Structures Monitoring Program in that the procedure will be enhanced to specify that the extent of observed masonry cracking and/or degradation of steel edge supports/bracing are evaluated, and corrective action is required to ensure that the current evaluation basis is still valid.

The staff reviewed the applicant's Structures Monitoring Program and its AERMs under the acceptance criteria program element of the Structures Monitoring Program. The staff noted that inspection criteria used to assess the condition of structures and structural components include the following:

- Concrete is inspected for loss of material, cracking and change in material properties aging effects.
- Masonry walls are inspected for cracking aging effect.
- Steel and other metals including threaded fasteners are inspected for loss of material and cracking aging effects.
- Elastomers are inspected for cracking and change in material properties aging effects.
- Earthen structures are inspected for loss of form aging effect.

The staff also noted that the applicant's responsible engineer identifies problems with structural performance, initiates structural deficiency reports and recommends corrective action. Acceptance criteria are typically established such that corrective actions are initiated prior to loss of function. The staff found this enhancement acceptable because when the enhancement is implemented, AMP B.2.39, "Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 6. In the letter dated September 23, 2008, the applicant added an enhancement to the "monitoring and trending," "acceptance," and "detection of aging effects" program elements the Structures Monitoring Program to include direction for quantifying, monitoring and trending of inspection results; guidance for inspection reporting, data collection and documentation; acceptance criteria and critical parameters for monitoring degradation and for triggering level of inspection and initiating of corrective action; and better alignment with referenced industry codes, standards and guidelines. The applicant also stated that the program will be enhanced to include specific qualification requirements for the inspector.

The staff reviewed the applicant's Structures Monitoring Program, the enhancement above, and its AERMs under the monitoring and trending program element of the Structures Monitoring Program. The staff found this enhancement acceptable because when the enhancement is implemented, AMP B.2.39, "Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Operating Experience. The staff also reviewed the applicant's OE described in LRA Section B.2.39 and the applicant's Operation Experience Review Report, and interviewed the applicant's technical staff to confirm that the plant-specific OE have been reviewed by the applicant and is evaluated in the GALL Report. During its audit, the staff conducted a field walk-down with the applicant's technical staff in the general areas and those listed in the LRA, e.g., the ESSW pumphouse's roof membranes, expansion joints and penetration leakage in the diesel generator building and the reactor building, and water leakage at penetrations located below grade exterior walls, etc. In general, the staff noticed some degradation. However, all of the observations are minor and acceptable per the applicant's inspection procedures and within the guidance of the ACI 201.1R (Guide for Making a Condition Survey of Concrete in Service) and ACI 349-3R (Evaluation of Existing Nuclear Safety-Related Concrete Structures) as recommended in the GALL Report.

The staff also confirmed that the applicant has addressed OE identified after the issuance of the GALL Report. The staff finds that the applicant's Structures Monitoring Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and

correcting the effects of aging on structures monitoring and the existing program OE revealed no degradation not bounded by industry experience.

On the basis of its review of the OE and discussions with the applicant's technical staff, the staff concluded that the applicant's Structures Monitoring Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited. The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.45 and Commitment No. 34 in Table A-1, the applicant provided the UFSAR supplement for the Structures Monitoring Program. The staff reviewed this section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of the audit and review of the applicant's Structures Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 34 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 Regulatory Guide 1.127 Water-Control Structures Inspection

Summary of Technical Information in the Application. LRA Section B.2.40 describes the existing RG 1.127 Water-Control Structures Inspection as consistent, with enhancements, with GALL AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants." The applicant stated that the program is implemented as part of the Spray Pond Inspection and Structures Monitoring Program.

The applicant also stated that, RG 1.127 Water-Control Structures are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements (Commitment No. 35) to determine whether the AMP, with the enhancements, is adequate to manage the aging effects for which it is credited by the LRA.

The staff interviewed the applicant's technical staff and reviewed the associated bases documents for the AMP B.2.40 "RG 1.127 Water-Control Structures Inspection," which provides an assessment of the AMP elements' consistency with GALL AMP XI.S7.

The staff also reviewed those portions of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program for which the applicant claims consistency with GALL AMP XI.S7.

Enhancement 1. LRA Section B.2.40 states an enhancement to the "scope of program" and "parameters monitored and inspected" program elements of the Structures Monitoring Program in that the procedure will be enhanced to add the Spray Pond (including concrete liners, emergency spillway, riser encasements and earthen embankments) to its scope for inspection.

The staff reviewed the applicant's RG 1.127 Water-Control Structures Inspection and its AERMs under the scope of program element. The staff noted that the ultimate heat sink for SSES consists of a concrete lined Spray Pond and an ESSW Pumphouse housing four RHRSW pumps and four ESW pumps which pump the water from the Spray Pond through their respective loops and back to the Spray Pond through a network of sprays located in the Spray Pond. The staff further noted that the Spray Pond is designed in accordance with seismic category I requirements. Earthen embankments are provided along the Spray Pond to ensure a minimum freeboard of 3 feet and to direct flood water away from safety-related facilities in a controlled manner. They are managed by both the Spray Pond Inspection and the Structures Monitoring Program. The staff also noted that (1) there are no water-control structures that fall under the regulatory jurisdiction of the Federal Energy Regulatory Commission (FERC) or the U.S. Army Corps of Engineers; (2) the Spray Pond Inspection includes a visual inspection of the Spray Pond and performance of groundwater level monitoring, and is credited for managing loss of material and cracking aging effects for the concrete lined Spray Pond and its appurtenances; and (3) the Structures Monitoring Program that includes a visual inspection of the Spray Pond, ESSW Pump house, and earthen embankments, is credited for managing loss of material, cracking, and spalling. The staff's review determined that this enhancement is acceptable because when the enhancement is implemented, the AMP B.2.40, "RG 1.127 Water-Control Structures Inspection," will be consistent with the GALL AMP XI.S7 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2. LRA Section B.2.40 states an enhancement to the "parameters monitored or inspected" program element of the Structures Monitoring Program in that the procedure will be enhanced to include RG 1.127 Revision 1 Section C.2 inspection elements and degradation mechanisms for water control structure inspection.

The staff reviewed the applicant's RG 1.127 Water-Control Structures Inspection, RG 1.127 Revision 1 Section C.2 requirements, the Structures Monitoring Program, and their AERMs under the parameters monitored or inspected program elements of the Structures Monitoring Program. The staff noted that the Spray Pond Inspection includes activities to inspect the exposed and accessible external surfaces of the Spray Pond and its appurtenances to determine material condition and to identify any signs of degradation that might affect its structural integrity and operation adequacy. The staff also noted that the Structures Monitoring Program monitors degradation mechanisms for the structure and structural components under investigation and that a potential degradation mechanism matrix is contained in SSES design standards which includes degradation mechanisms that require monitoring for license renewal. The SMP will be enhanced to include parameters monitored and inspected for water-control structures in accordance with inspection elements listed in Section C.2 of RG 1.127 Revision 1. The staff found this enhancement acceptable because when the enhancement is implemented, the AMP B.2.40, "RG 1.127 Water-Control Structures Inspection," will be consistent with GALL AMP XI.S7 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3. LRA Section B.2.40 states an enhancement to the "acceptance criteria" program element of the Structures Monitoring Program in that the procedure will be enhanced to include acceptance criteria as delineated in GALL AMP XI.S7 for Water-Control Structures.

The applicant stated that evaluation criteria provided in Chapter 5 of ACI 349.3R-96 provides acceptance criteria (including quantitative criteria) for determining the adequacy of observed aging effects and specifies criteria for further evaluation.

The staff reviewed the applicant's RG 1.127 Water-Control Structures Inspection, Chapter 5 of ACI 349.3R-96, the Structures Monitoring Program, and their AERMs under the acceptance criteria program element of the Structures Monitoring Program. The staff noted that the acceptance criteria for the Spray Pond Inspection uses the six (6) permanent piezometer wells (located in soil) along the perimeter of the Spray Pond; when the applicant determines that the actual groundwater level has reached elevation 663 feet at any one of the six piezometer locations, the following actions will be taken:

- NRC will be notified of the high (elevation 663') groundwater condition;
- Steps will be taken to identify the cause of the rise in the water level;
- An assessment of the safety impact of the occurrence will be performed;
- Appropriate actions will be taken based on the findings of the safety impact analysis.

The staff further notes that the applicant's responsible engineer identifies problems with structural performance, initiates structural deficiency reports, and recommends corrective action. Acceptance criteria are established such that corrective actions are initiated prior to loss of function.

The acceptance criteria for the Structures Monitoring Program include the following:

- Concrete is inspected for loss of material, cracking and change in material properties aging effects.
- Steel and other metals including threaded fasteners are inspected for loss of material and cracking aging effects.
- Elastomers are inspected for cracking and change in material properties aging effects.
- Earthen structures are inspected for loss of form aging effect.

The staff found this enhancement acceptable because when the enhancement is implemented, AMP B.2.40, "RG 1.127 Water-Control Structures Inspection," will be consistent with the GALL AMP XI.S7 and provide additional assurance that the effects of aging will be adequately managed.

Operating Experience. The staff also reviewed the applicant's OE described in LRA Section B.2.40, Operation Experience Review Report (RG 1.127 Water-Control Structures Inspection's section), and interviewed the applicant's technical staff to confirm that the plant-specific OE have been reviewed by the applicant. The applicant indicated that it found some minor indications that did not affect the structural integrity of any of the structures reviewed. The staff found that visual examinations conducted by the Spray Pond Inspection as implemented by the Structures Monitoring Program have not found any age-related problems or degraded conditions that could affect their intended function. The SSES RG 1.127 Water-Control Structures Inspection has demonstrated that it provides assurance that aging effects are being managed. The staff also confirmed that the applicant has addressed OE identified after the issuance of the GALL Report. The staff finds that the applicant's RG 1.127 Water-Control Structures Inspection Program, has been effective in identifying, monitoring, and correcting the aging effects on WCS and that existing program OE revealed no degradation not bounded by

industry experience. The staff confirmed that the OE program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.42 and Commitment No. 35 in Table A-1, the applicant provided the UFSAR supplement for the RG 1.127 Water-Control Structures Inspection. The staff reviewed this section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of the audit and review of the applicant's RG 1.127 Water-Control Structures Inspection, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 35 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.19 Fatigue Monitoring Program

Summary of Technical Information in the Application. Section B.3.1 of the LRA describes the existing program, "Fatigue Monitoring Program (FMP)." The LRA describes this program as consistent with the GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary" with enhancements. The LRA states the purpose of the program is to manage the fatigue for all Class 1 components. The FMP tracks the number and severity of critical thermal and pressure transients for the selected reactor coolant system (RCS) components. The LRA indicates that there is no exception for this program to the GALL AMP X.M1, however, enhancements will be implemented prior to the period of extended operation in order for this program to be consistent with the 10 elements described GALL AMP X.M1.

Staff Evaluation. The staff reviewed the technical information in the LRA to verify the consistency of this program to the GALL AMP X.M1 and to assess the adequacy of this program. The staff review identified several areas where it needed additional information to complete the review of the SSES FMP. The staff transmitted RAIs to the applicant by letters dated July 3, 2008, and October 22, 2008. The applicant responded to the staff RAIs by letters dated August 1, 2008, and December 12, 2008.

The program description states that FMP monitors and tracks the number and severity of critical thermal and pressure transients for the selected RCS components. In RAI B.3.1-1, the staff requested the applicant to describe how this tracking and monitoring is accomplished.

The applicant's response indicated that the FMP is implemented by an approved engineering procedure. The critical plant transients are monitored using two methods. Some of the transients are automatically counted using computer software analysis of specific plant operating data such as temperatures, pressures and flow rates. Those events that cannot be automatically counted are manually counted by review of plant data and operating logs. The applicant indicated that the SSES cycle counting procedure assumes that every event occurs at

the full design value. The staff finds this procedure provides an acceptable method to track design transient cycles for comparison to the number of cycles used in the fatigue evaluation of ASME Class 1 components.

Section 4.3.1 of the LRA indicates that the design transients are monitored using the computer software FatiguePro. In RAI B.3.1-2, the staff asked the applicant to confirm whether FatiguePro is a part of the FMP and describe the role FatiguePro has in the FMP. In addition, the staff asked the applicant to confirm whether FatiguePro is used for stress-based monitoring, and if so, list the components that are stress-based monitored.

The applicant's response indicated that FatiguePro software is used for stress-based fatigue (SBF) monitoring of the FW nozzle forgings, FW nozzle safe ends, and the CRD penetrations. The applicant also indicated that FatiguePro is used to identify and count transient cycles from the plant operating data. The transients that cannot be automatically counted are manually entered into the FatiguePro database. FatiguePro is also used to calculate the fatigue CUF at the limiting plant locations.

Previous LRA reviews determined that FatiguePro may use simplifying assumptions in the SBF evaluation. The staff issued a draft regulatory information summary: "Fatigue Analysis of Nuclear Power Plant Components," May 1, 2008, (73 FR 24094) which questioned the conservatism of the simplifying assumptions used in the analysis methodology associated with a Green's function that has been used for the detailed analysis of some components for license renewal. The final reversion was issued on December 16, 2009 with no substantive changes from the draft. In RAI B.3.1-7, the staff asked the applicant to provide the following information regarding the fatigue evaluation, including environmental fatigue effects at the NUREG/CR-6260 locations:

- Provide the details for the management of environmentally-assisted fatigue components during the period of extended operation, including the elements to the AMP such as scope, qualification, method and frequency.
- For all locations where 60-year environmental CUF is below 1.0, clarify whether any of these values have been calculated using the Green's Function Methodology and if so please describe the details of how Green's Function was used to calculate the CUF values.

The applicant's response indicated that all eleven locations in LRA Table 4.3-3 will be managed for environmentally-assisted fatigue by the SSES FMP. The applicant also indicated that the environmental CUF at these locations would be updated once every fuel cycle and corrective actions would be initiated prior to the CUF reaching the allowable limit at the monitored locations. The staff finds this response acceptable because the applicant will monitor the fatigue usage on a periodic basis and initiate appropriate corrective actions prior to the fatigue CUF exceeding its allowable limit.

The applicant's response indicated that the Green's Function Methodology was used for the SBF monitoring of the FW nozzle forging and nozzle safe end. In its response to RAI B3.1-1, the applicant indicated that the SBF methodology had been benchmarked against the relevant design basis stress report for each component. The staff requested that the applicant provide additional information regarding the benchmarking of the methodology. In RAI 4.3-11, the staff requested that the applicant provide the following additional information regarding the benchmarking of the SBF methodology:

a. Describe the procedure used to benchmark the SBF monitoring locations against the relevant design reports. List the transients used for the benchmarking and indicate the design fatigue usage associated with each transient.

b. Discuss how the SSES SBF monitoring addresses the concern raised in proposed Regulatory Information Summary (RIS), "Fatigue Analysis of Nuclear Power Plant Components," May 1, 2008, (73 FR 24094). Indicate whether any additional benchmarking of the SSES SBF monitoring is planned.

The applicant's response described the procedure used to benchmark the SBF fatigue monitoring locations for the FW nozzle safe and the CRD penetration locations. The applicant indicated that key transient pairings from the design basis stress reports were used to adjust the Green's functions so the stresses from the Green's function bounded the stresses from the design report. The adjustment assures that the Green's function stresses bounded the stresses from the design report for the key transient pairings.

The applicant also indicated that the benchmark calibrations were not performed for all possible transient pairing scenarios. The applicant could not confirm that the benchmark calibration procedure for the key transient pairings fully addressed all possible transient pairing scenarios. Therefore, the applicant committed (Commitment No. 60) to either: (1) implement fatigue monitoring software that satisfactorily addresses all issues raised in the proposed RIS, or (2) perform a confirmatory ASME Code, Section III fatigue evaluation for the SBF monitored locations to justify the existing FatiguePro methodology used at SSES Units 1 and 2. This commitment will be completed prior to the period of extended operation. The staff finds the applicant's commitment adequately addresses the technical concern indentified in the draft RIS and is acceptable.

Enhancement 1. The FMP has an enhancement to the GALL Report program elements "preventive actions, monitoring and trending." The LRA states that additional actions may be taken when sufficient fatigue accumulation has occurred, if determined necessary to address fatigue-related concerns. The staff found the above LRA statement does not provide sufficient details to determine that FMP will prevent the design limit being reached. In RAI B.3.1-3, the staff asked the applicant to explain what is meant by sufficient fatigue accumulation, describe the criteria used to determine if further actions are required, and to provide the periodicity of the updates for CUF values.

The applicant's response indicated that it had revised LRA Commitment No. 43 to include specific action levels be determined for each monitored location. The revised commitment requires the applicant to initiate actions at least 4 years prior to the projected CUF of any monitored component reaching its allowable limit. In addition, the applicant committed to update the fatigue calculation at least once every refueling cycle. The staff finds the applicant's revised Commitment No. 43 provides adequate assurance that corrective actions will be initiated prior to exceeding the allowable limit at any of the locations monitored by the SSES FMP.

The staff found this enhancement acceptable because when the enhancement is implemented, the applicant's program will be consistent with the recommendations of GALL AMP X.M1.

Enhancement 2. The FMP has an enhancement to the GALL Report program elements "preventive actions" and "acceptance criteria." This enhancement will address environmental

effects on fatigue at specified locations in NUREG/CR-6260. The staff reviewed this enhancement and found that it does not apply to the "preventive actions" and "acceptance criteria" elements of GALL AMP X.M1. These two elements in the GALL AMP relate to maintaining the fatigue usage factor below the design limit and monitoring the plant transients. The enhancement therefore is not applicable to these program elements. In RAI B3.1-4, the staff asked the applicant to explain how this enhancement to address environmental effects is applicable to these two elements of GALL AMP X.M1.

The applicant's response provided a revision to the FMP described in LRA Appendix B, Section B.3.1 and LRA Commitment No. 43 to clarify that the enhancements to address environmental effects on fatigue at the NUREG/CR-6260 locations also include monitoring the locations for environmental fatigue usage and acceptance criteria that the environmental fatigue usage does not exceed the allowable limit. The staff finds the applicant's FMP revision acceptable because it satisfies GALL AMP X.M1.

Consistent with the GALL Report X.M1, the FMP will provide for periodic updates of the fatigue usage calculations. However, the LRA is not clear on the corrective actions that will be taken if the updated CUF calculations are projected higher than the allowable limits. In RAI B.3.1-5, the staff asked the applicant to state the exact actions that will be taken if FMP projects CUF values higher than the allowable limit.

The applicant's response indicated that when an action level as defined in the response to RAI B.3.1-3 is reached, an action request will be generated to require further engineering evaluation of the monitored location. The engineering evaluation would attempt to demonstrate that the CUF remains below the allowable limit through analysis refinements. If the analysis cannot demonstrate that the CUF remains below the allowable limit, the applicant proposed the following further options:

- Repair the component
- Replace the component
- Manage the component through inspection and flaw tolerance

The applicant's proposed actions to perform an engineering evaluation to demonstrate the CUF remains within its allowable limit or repair/replacement of the component are consistent with GALL AMP X1.M1 and are acceptable. The applicant's proposal to manage the component through inspection and flaw tolerance would require NRC review and approval as stated in LRA Commitment No. 43.

Operating Experience. In the OE section of the FMP its states that industry OE has been factored into the SSES FMP, however this section does not list or describe the applicable OE that was reviewed by the applicant. The GALL Report X.M1 recommends that industry OE is reviewed as part of the program and any applicable experience should be considered to be incorporated into the FMP. In RAI B.3.1-6 the staff asked the applicant to list the documents reviewed and provide the corresponding follow-up actions taken by SSES from any applicable experience.

The applicant's response provided a list of documents reviewed as part of its FMP. These documents included NRC bulletins and industry publications as well as other license renewal applications relevant to fatigue of RCPB components. In addition, the applicant indicated that SSES was an early participant in using fatigue monitoring of RCPB components and that SSES maintains its participation in industry peer review groups. On the basis of the applicant's

response to RAI B3.1-6, the staff finds that the applicant has considered the relevant industry experience related to the fatigue of RCPB components.

The staff found this enhancement acceptable because when the enhancement is implemented, the applicant's program will be consistent with the recommendations of GALL AMP X.M1.

UFSAR Supplement. 10 CFR 54.21(d) states that the UFSAR supplement for the facility must contain a summary description of the programs and activities for managing the effects of aging. The staff did not find a UFSAR Supplement for the Fatigue Monitoring Program, B.3.1. In RAI B.3.1-8, dated July 3, 2008, the staff asked the applicant to provide the UFSAR Supplement for AMP B.3.1.

In response to RAI B.3.1-8, dated August 1, 2008, the applicant provided an amendment to LRA Appendix A to address the FMP. The amendment added a new Section A.1.2.49, Commitment No. 43, which described the FMP, including the program enhancements that will be implemented prior to the period of extended operation. In addition, the UFSAR Supplement specifies corrective actions that will be implemented if the fatigue usage at any monitored location is projected to exceed its design limit prior to the period of extended operation. The staff reviewed the applicant's LRA amendment and finds that provides an adequate summary description of the FMP.

The staff reviewed the UFSAR supplement and determines that it provides an adequate summary description of the program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's FMP, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff has reviewed the information provided in Section B.3.1 of the LRA and additional information provided by the applicant by letters dated August 1, 2008, and December 12, 2008. Also, the staff reviewed the enhancements and confirmed that they will be implemented through Commitment No. 43 prior to the period of extended operation. On the basis of its review as discussed above, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 Fuse Holders Program

Summary of Technical Information in the Application. LRA Section B.2.50 describes the new Fuse Holders Program as consistent, with exception, with GALL AMP XI.E5, "Fuse Holders." The applicant stated that this aging management program will manage increased connection resistance due to fatigue of the fuse holder metallic clamp for fuse holders in the scope of the program. This program will be used to ensure that the metallic clamps of the fuse holders are not loosening due to removal and reinsertion of fuses.

In the LRA, Section 3.6.2.3.1, the applicant states that the fuse holders are located in metallic electrical boxes (terminal boxes) which have covers that protect the interior of the box from the environment. The applicant also states that the boxes are not exposed to weather (they are located indoors at SSES); they are not exposed to chemical contamination or spills. Therefore, the applicant concluded that chemical contamination, corrosion, and oxidation are not

applicable aging effects for the metallic clamps of the fuse holders within the license renewal scope at SSES. With respect to electrical transients and ohmic heating, the applicant states that these fuses are not heavily loaded and do not experience frequent electrical and thermal cycling. The power fuses with bolted connections used Belleville washers to maintain good electrical contact in event of any differential thermal expansion. With respect to vibration, the applicant states that the electrical boxes are mounted on walls; vibration is not an applicable aging mechanism.

Furthermore, the applicant states that inspection of a sample of the 20 in-scope metal electric boxes containing the fuse holders showed no corrosion or evidence of water intrusion or collection and the metallic electrical boxes were clean and dry.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception is adequate to manage the aging effects for which the LRA credits it. The staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed and compared the "scope of program," "preventative actions," "parameters monitored/detected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience" program elements of the AMP to the corresponding program element criteria in GALL AMP XI.E5, "Fuse Holders."

Exception. LRA Section B.2.50 states an exception to the "parameters monitored/inspected" program element of GALL AMP XI.E5 such that it monitors only the mechanical fatigue of the metallic clamp portion of the fuse holder caused by removal and insertion of the fuse. The applicant stated that none of the other aging effects/mechanisms identified in this GALL Report element are applicable. The staff noted that the in-scope fuse holders are installed in metal terminal boxes, which are separate from sources of vibration. Therefore, vibration is not an applicable aging mechanism. The terminal boxes are located inside the rooms that have a controlled environment that protects the panels from the weather. They are not exposed to potential system leakage or spills. With regard to internal moisture, the applicant inspected a sample of terminal boxes and found the surface condition of the terminal boxes showed no signs of corrosion or water intrusion. Therefore, corrosion is not an applicable aging mechanism. With respect to thermal ohmic heating or thermal cycling, these fuse holders are not used in heavy loading (control powers). In addition, these fuse holders are bolted connections using Belleville washers to prevent thermal expansion of different material. Based on this information, the staff determines that ohmic heating, thermal cycling or electrical transients, vibration, chemical contamination, corrosion and oxidation are not applicable aging mechanisms/effects for the metallic clamps of the fuse holders within the scope of license renewal at SSES. Therefore, the staff finds that the exception to the "parameters monitored/inspected" element acceptable.

The staff compared the programs elements in the applicant's program to those in GALL AMP XI.E5 and verified that the program elements were consistent. The staff found the applicant's AMP acceptable because it conforms to the recommended GALL Report AMP with the exception described above.

Operating Experience. The staff reviewed the applicant's OE described in LRA Section B.2.50. The applicant stated that the Fuse Holders Program is a new program for which there is no SSES-specific OE. The applicant also stated that during routine preventive maintenance activities in 2005, a fuse holder in a Unit 1 FW control panel was identified as being slightly warmer than other fuse holders in the same location due to loosening of the fuse holder metallic

clamps. The fuse holder was replaced, and post-maintenance testing, using thermography, confirmed the condition was corrected. In addition, the applicant stated that in 2004, a fuse holder in a Unit 2 reactor building chiller control panel was identified as being slightly warmer than other fuse holders in the same location due to loosening of the fuse holder metallic clamps. The fuse holder was replaced, and post-maintenance testing, using thermography, confirmed the condition was corrected. The condition was detected prior to loss of intended function in both of these cases.

The staff finds that the OE identified above demonstrates that the applicant's identification of early problems with fuse holders and correction of them prior to loss of intended functions provide assurance that the program will remain effective in assuring that equipment is maintained during the period of extended operation.

The staff finds that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.51 and Commitment No. 59 in Table A-1, the applicant provides its UFSAR Supplement for the Fuse Holders Program. The staff reviewed the UFSAR supplement and determines that it provides an adequate summary description of the program as required by 10 CFR 54.21(d). The applicant has committed to implement this AMP prior to the period of extended operation.

Conclusion. On the basis of its review of the applicant's Fuse Holders Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs Not Consistent with or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as plant-specific:

- Area-Based Nonsafety-affecting Safety Inspection
- Leak Chase Channel Monitoring Activities
- Preventive Maintenance Activities - RCIC/HPCI Turbine Casings
- Preventive Maintenance Activities – Main Turbine Casings

For AMPs not consistent with or not addressed in the GALL Report the staff performed a complete review to determine their adequacy to monitor or manage aging. The staff's review of these plant-specific AMPs is documented in the following sections.

3.0.3.3.1 Area-Based Nonsafety-Affecting Safety (NSAS) Inspection

Summary of Technical Information in the Application. LRA Section B.2.46 describes the Area-Based NSAS Inspection Program as plant-specific. This program involves a one-time inspection of the internal surfaces of nonsafety-related components that are exposed to non-radioactive

drainage water or potable water environments. Also inspected are the internal surfaces of copper alloys exposed to raw water from the spray pond/cooling tower. The applicant stated that the one-time inspection will ensure that the structural integrity of nonsafety-related components is maintained such that spatial interactions such as leakage will not result in the loss of intended function of safety-related components during the period of extended operation.

Staff Evaluation. The staff reviewed the Area-Based NSAS Inspection against the AMP elements found in the GALL Report, in the SRP-LR Section A.1.2.3, and in the SRP-LR Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 program elements (i.e., "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" program elements are part of the LRA Section B.1.3, Quality Assurance Program and Administrative Controls. The staff's evaluation of LRA Section B.1.3 program is discussed in SER Section 3.0.4. The remaining seven elements are discussed below.

Scope of Program. LRA Section B.2.46, states that the scope of this program includes confirming the environmental and/or internal surface conditions of nonsafety-related carbon steel, cast iron, copper alloy, and stainless steel components in systems that contain non-radioactive equipment/area drainage water or potable water, as well as for copper alloy components in systems that contain raw water. The applicant further stated that for systems containing non-radioactive equipment/area drainage water or potable water, as well as for copper alloy components in systems that contain raw water, a sample of copper alloy components will be examined for evidence of SCC.

The original LRA limited the inspection of copper alloy components to systems where ammonia or ammonium compounds were detected. By letter dated September 30, 2008, the applicant deleted the requirement that limited the inspection of copper alloy components to systems where ammonia or ammonium compounds were detected.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1 which states that "The specific program necessary for license renewal should be identified. The scope of the program should include the specific structures and components of which the program manages the aging."

The staff finds that the applicant identified the program necessary for license renewal and specified the specific structures and components consistent with SRP-LR Section A.1.2.3.1. The staff confirmed that the "scope of program" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable

Preventive Actions. LRA Section B.2.46 states that no actions are taken as part of the Area-Based NSAS Inspection to prevent aging effects or to mitigate aging degradation.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2.2, which states that condition monitoring or performance monitoring programs do not rely on preventive actions.

Since this is a condition monitoring program, the staff concludes that this program does not rely on preventive actions. The staff confirmed that the "preventive actions" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

Parameters Monitored or Inspected. LRA Section B.2.46 states that parameters inspected will include wall thickness and/or visual evidence of internal surface degradation. The internal surfaces of copper alloy components will be inspected using visual or volumetric inspection to detect SCC.

The original LRA limited the inspection of copper alloy components to systems where ammonia or ammonium compounds were detected. By letter dated September 30, 2009, the applicant deleted the requirement that limited the inspection of copper alloy components to systems where ammonia or ammonium compounds were detected.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criterion in SRP-LR Section A.1.2.3.3.1, which states that, "The parameters to be monitored or inspected should be identified and linked to the degradation of the particular structure and component intended function(s)."

The applicant describes what kind of inspections will be conducted. The applicant also discusses that degradation of these nonsafety-related systems and components (while not expected) are conducted to ensure that spatial interactions do not occur that could impair or prevent a safety-related function. The applicant also states that a focused characterization of conditions is warranted to provide confirmation of a lack of degradation or to serve as the basis for recurring actions during the period of extended operation, if required.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

Detection of Aging Effects. LRA Section B.3.46 states: "The Area-Based NSAS Inspection will use a combination of established volumetric and visual examination techniques performed by qualified personnel on a sample population of subject nonsafety-related components exposed to non-radioactive
equipment/area drainage water or potable water to identify evidence of a loss of material or to confirm a lack thereof. The results of the inspection will be applied to all of the components within the scope of the inspection activity."

The LRA also states: "If needed, based on engineering evaluation, the Area-Based NSAS Inspection, will use a combination of established volumetric and visual examination techniques performed by qualified personnel on a sample population of select nonsafety-related systems, structures, and components. This program will use a combination of volumetric and visual examination techniques on a sample population to identify evidence of loss of material or to confirm lack of it. This program will also use a combination of volumetric and visual examination techniques on a sample population to identify evidence of SCC or a lack of SCC."

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4 which states that the inspections should be the proper inspections to detect the anticipated aging effects. In addition, this program element should tell when the inspections will be conducted and, if sampling is used, how the sample size will be

determined. Finally, the inspections should be concentrated in areas thought to be the most susceptible to degradation.

The applicant stated that it will use industry accepted inspections using qualified inspectors. The inspections will be conducted within 10 years of entering the period of extended operation. The locations to be inspected will be selected based on engineering evaluation and will be concentrated in areas thought to be the most susceptible to degradation.

The staff review finds that the applicant's program uses the proper types of inspections to detect the kinds of aging anticipated. The selection of locations for inspection based on engineering evaluation is also acceptable. Finally, selection of areas anticipated to have the most degradation is also acceptable.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion as defined in GALL Report and in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

Monitoring and Trending. LRA Section B.2.46 states: "No actions are taken as part of the Area-Based NSAS Inspection to monitor and/or trend inspection results. This is a one-time inspection used to determine if, and to what extent, further actions such as monitoring and trending may be required. Results of inspections, including follow-up inspections, are routinely evaluated through the site corrective action process, if necessary."

The staff reviewed the "monitoring and trending" program element and found that the SRP-LR Section A.1.2.3.5 is not applicable because this is a one-time inspection and there is no monitoring and trending unless unanticipated degradation is detected.

The staff confirmed that the "monitoring and trending" program element does not satisfy the criterion defined in SRP-LR Section A.1.2.3.5 because this is a one-time inspection so monitoring and trending does not apply. The staff finds this program element acceptable.

Acceptance Criteria. LRA Section B.2.46 states that there will be no unacceptable loss of material, wall thinning, or SCC that could result in spatial interaction with safety-related components during the period of extended operation, as determined by engineering evaluation.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6 which states that the acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the structure and component intended function(s) are maintained under all CLB design conditions during the period of extended operation and the program should include a methodology for analyzing the results against applicable acceptance criteria.

The structures and components inspected as part of the NSAS Inspection Program are nonsafety-related structures and components and this is a new program. However, the applicant has identified appropriate acceptance criteria and how the age related degradation will be evaluated. On the basis of its review, the staff finds this program element acceptable.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

Operating Experience. The staff reviewed the applicant's OE described in LRA Section B.2.26. The applicant stated that the Area-Based NSAS Inspection is a new one-time inspection for which there is no OE indicating the need for an aging management program.

In a letter dated June 10, 2008, the staff issued RAI B.2-1 that is consistent with the statement in the SRP-LR Section A.1.2.3.10, that the applicant make a commitment to provide OE in the future to the staff for new AMPs to confirm their effectiveness for the period of extended operation. In its letter dated July 8, 2008, the applicant responded to RAI B.2-1 and stated that OE for new aging management programs described in LRA Appendix B will be gained as these new programs are implemented during the period of extended operation. The applicant stated that results of tests, inspections, and other aging management activities conducted in accordance with these programs will be subject to confirmation and corrective action elements of the Susquehanna 10 CFR Part 50, Appendix B, quality assurance program and that results will be subject to NRC review during regional inspections under existing NRC inspection modules. The applicant further stated that one-time inspections will be performed prior to entry to the period of extended operation to confirm the effectiveness of these aging management programs, and that these programs are subject to review under NRC Inspection Procedure 71003, Post-Approval Site Inspection for License Renewal.

The staff noted that post-approval site inspections provide an opportunity for staff review and assessment of the effectiveness of the applicant's Area-Based NSAS Inspection Program after the applicant has developed OE with that program. The staff concludes that the corrective action program, based on internal and external plant OE, would capture OE in the future to support the conclusion that the effects of aging are adequately managed. On this basis, the staff finds the response acceptable.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds that this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.1 and Commitment No. 40 in Table A-1, the applicant provided the UFSAR supplement for Area Based Nonsafety Affecting Safety Inspection Program. The applicant has committed to implementing the Area Based Nonsafety Affecting Safety Inspection Program within the 10 year period prior to the period of extended operation.

The staff determines that the information in the UFSAR Supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's Area Based Nonsafety Affecting Safety Inspection Program including the applicant's response to the staff RAI, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.2 Leak Chase Channel Monitoring Activities

Summary of Technical Information in the Application. LRA Section B.2.47 describes the existing Leak Chase Channel Monitoring Activities as plant-specific. In the LRA, the applicant stated

that AMP B.2.47 is an existing plant-specific condition monitoring program consisting of observation and surveillance activities to detect leakage from the spent fuel pool and the fuel shipping cast storage pool liners due to age-related degradation within the scope of license renewal.

Staff Evaluation. The staff reviewed the Leak Chase Channel Monitoring Activities against the AMP elements found in the GALL Report, in SRP-LR Section A.1.2.3, and in SRP-LR Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 program elements. The staff's evaluations on seven of these elements follow.

Scope of the Program. LRA Section B.2.47 states that the program includes periodic monitoring of the spent fuel pool and fuel shipping cask storage pool leak chase system. The applicant also stated that the program is credited for detecting loss of material aging effects for the spent fuel pool and fuel shipping cask storage pool liners.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific structures and components of which the program manages the aging. The staff found the applicant has identified the specific structures and components of which the aging effects are managed. On this basis, the staff finds the applicant's scope of the program acceptable.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

Preventive Actions. LRA Section B.2.47 states that no actions are taken as part of the program to prevent aging effects or mitigate age-related degradation.

The staff reviewed the "preventive actions" program element criterion in SRP-LR Section A.1.2.3.2 which states that condition monitoring programs do not rely on preventive actions, and thus, preventive actions need not be provided. Therefore, this program element is acceptable because this is a condition monitoring program and there is no need for preventive actions.

Parameters Monitored or Inspected. LRA Section B.2.47 states that the spent fuel pool and fuel shipping cask storage pool liner leak detection drain valves are periodically opened and the leak rate estimated by the volumetric method. The applicant also stated that this ensures evidence of leakage from the spent fuel pool and fuel shipping cask storage pool liner is promptly identified and corrected if necessary.

The applicant further stated that the program includes activities to cycle open and close spent fuel pool and fuel shipping cask storage pool liner drain valves and measure and report any water collected to shift supervision.

The staff reviewed the "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3 which states that the parameters to be monitored or inspected should be identified and linked to the degradation of the particular structure and component intended function(s).The staff found the program identifies the parameters to be monitored or inspected and linked them to the degradation of the particular structures and

components intended functions by collecting, measuring and reporting any water collected to the shift supervision for further action.

This staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

Detection of Aging Effects. LRA Section B.2.47 states that the spent fuel pool and fuel shipping cask storage pool drain valves are cycled and the volume of any water collected is measured. The applicant also stated that estimating the time from start of opening valve until flow slows to a slow drip is also performed for known leakage.

The staff reviewed the "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that the parameters to be monitored or inspected should be appropriate to ensure that the structure and component intended function(s) will be adequately maintained for license renewal under all CLB design conditions. The staff found the applicant has identified the drain valves for the spent fuel pool and fuel shipping cask storage are cycled and the volume of any water collected is measured as required under their CLB design conditions.

This staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

Monitoring and Trending. LRA Section B.2.47 states that leak chase channel monitoring activities are performed at least once quarterly. The applicant also stated that the routine task requires that any water collected in excess of one pint is reported to shift supervision. Shift supervision will then notify Nuclear System Engineering by an appropriate mechanism. The applicant further stated that data are entered into the Shift Operations Management System log for trending purposes even if no leakage was identified.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5 which states that the program element describes "how" the data collected are evaluated and may also include trending for a forward look. This includes an evaluation of the results against the acceptance criteria and a prediction regarding the rate of degradation in order to confirm that timing of the next scheduled inspection will occur before a loss of SC intended function.

The staff found that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5 because the applicant provides predictability of the extent of degradation and thus effects timely corrective or mitigative actions e.g., monitoring activities are performed at least once quarterly and evaluation of the results against the acceptance criteria, and a prediction regarding the rate of degradation before a loss of structures component intended function. The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

Acceptance Criteria. LRA Section B.2.47 states the acceptance criterion is less than one pint of measured leakage from each liner leak chase drain valve. The applicant also stated that the one pint criterion is based on SSES plant-specific historical accumulation of water at Unit 2 spent fuel pool drain points.

The staff reviewed the "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6 which states that the acceptance criteria of the program and its basis should be described. The staff found that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6 since; the applicant has provided the predetermined criteria as quantitative inspections by personnel in accordance with the approved site-specific programs. On this basis, the staff finds this program element acceptable.

Operating Experience. The staff also reviewed the applicant's OE described in LRA Section B.2.47, "Operation Experience Review Report (Leak Chase Channel Monitoring Activities' section)", and to confirm that the plant-specific OE have been reviewed by the applicant. The staff found that the Leak Chase Channel Monitoring Activities have indicated small leakage in the Unit 2 spent fuel pool. The Unit 1 spent fuel pool and the common fuel shipping cask storage pool liners have shown no leakage. The staff reviewed CR 94-251 (April 4, 1994) Reported leakage from Fuel Pool drain valves 253082A thru valves 253082E and found: for the first time in three months, valves 253082A has 40 gallons, and all of other valves (valves 253082B - valves 253082E were dry. However, on December 5, 2006, OPS PM S5477 (CR 830720) identified no leakage at valve 253082A, and therefore, the tracking and trending was closed. The applicant noted in the LRA that, based on the expected leakage from this small leak as well as minor drainage previously noted at liner drain valves "B" and "E," the inspection frequency has been accelerated to monthly for the Unit 2 spent fuel pool. For the past five years, the Unit 2 spent fuel pool liner leakage measurements have all been within the acceptance criteria.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.27 and Commitment No. 41 in Table A-1, the applicant provided the UFSAR supplement for the leak Chase Channel Monitoring Activities. The staff reviewed this section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Leak Chase Channel Monitoring Activities, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.3 Preventive Maintenance Activities - RCIC/HPCI Turbine Casings

Summary of Technical Information in the Application. LRA Section B.2.48 describes the existing Preventive Maintenance Activities – RCIC/HPCI Turbine Casings as a plant-specific AMP. The applicant stated that this program manages loss of material due to general corrosion on internal surfaces of RCIC and HPCI pump turbine casings, and on piping and piping components such as rupture disks and valve bodies made of carbon steel or cast iron.

Staff Evaluation. The staff reviewed the Preventive Maintenance Activities – RCIC/HPCI Turbine Casings as an existing program that is plant-specific. There is no corresponding AMP in the GALL Report.

The staff reviewed the Preventive Maintenance Activities – RCIC/HPCI Turbine Casings Program against the AMP elements found in SRP-LR Section A.1.2.3 and SRP-LR Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 elements (i.e., "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" program elements are part of the LRA Section B.1.3, Quality Assurance Program and Administrative Controls. The staff's evaluation of LRA Section B.1.3 program is discussed in SER Section 3.0.4. The remaining seven elements are discussed below.

Scope of Program. LRA Section B.2.48 states that this program will manage loss of material due to general corrosion of the internal carbon steel and cast iron surfaces in the RCIC and HPCI pump turbine casings and in-scope piping and piping components in steam lines downstream from the steam admission valves that are exposed to ambient air during normal plant operation. The applicant stated that this ambient air internal environment is untreated and will be moist as a result of steam that has condensed and drained to the barometric condensers or vented to the drywell.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1 which states that, "The specific program necessary for license renewal should be identified. The scope of the program should include the specific structures and components of which the program manages the aging."

In its letter dated October 21, 2008, in response to the NRC regional inspection of the LRA, the applicant included an enhancement in the "scope of program" program element to include a specific step to perform a visual inspection of the RCIC turbine casing. The cast iron components are subject to a visual inspection and a hardness test to determine if selective leaching has occurred. The staff's review of the "Selective Leaching Program" can be found in section 3.0.3.1.17. The staff finds the enhancement acceptable because the enhancement provides details that makes the "scope of program" program element satisfy the criterion defined in SRP-LR Section A.1.2.3.1.

The staff finds this program element acceptable because it adequately describes the scope of the program.

The staff confirmed that the "scope of the program" (called the "scope of activity" in the LRA) program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

Preventive Actions. LRA Section B.2.48 states that no actions are taken as part of the Preventive Maintenance Activities – RCIC/HPCI Turbine Casings Program to prevent aging effects or to mitigate age-related degradation.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2-2., which states that condition monitoring or performance monitoring programs do not rely on preventive actions.

Since this is a condition monitoring program, the staff concludes that this program does not rely on preventive actions.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2-2. The staff finds this program element acceptable.

Parameters Monitored or Inspected. LRA Section B.2.48 states that this program inspects the internal carbon steel surfaces of RCIC and HPCI pump turbine casings and the cast iron surfaces of the associated gland cases for signs of degradation for evidence of loss of material.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that for a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects.

By letter dated July 9, 2008, the staff issued RAI B.2.48-1 asking the applicant to provide more details of the types of inspections that will be conducted. Specifically, the staff asked the applicant to provide the method used to inspect, the frequency of inspections, and the type of data collected. By letter dated August 8, 2008, the applicant responded that the inspection of RCIC and HPCI pump turbine internals, including the casings, is a skill-based visual inspection performed by Mechanical Maintenance personnel. The inspection follows SSES procedures and includes inspections for loose parts, mechanical damage, corrosion, erosion, pitting, scale deposits, and other abnormal wear. The procedure for the HPCI turbine includes visual inspection for the turbine casing which was not included for the RCIC turbine. A commitment (Commitment No. 42) has been added to the LRA committing to an enhancement to add the visual inspection for the RCIC turbine casing. The applicant also stated that the frequency of inspections will be a 10-year frequency and any deficiencies noted will be entered into the corrective action program for evaluation.

The staff finds this program element acceptable, because in response to RAI B.2.48-1 the applicant has appropriately identified the inspection methods, frequency of testing and the type of data collected.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

Detection of Aging Effects. LRA Section B.2.48 states that this program will detect loss of material prior to any loss of component intended functions.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP LR Section A.1.2.3.4, which states that the parameters to be monitored or inspected should be appropriate to ensure that the structure and component intended function(s) will be adequately maintained for license renewal under all CLB design conditions. This includes aspects such as method or technique (e.g., visual, volumetric, surface inspection), frequency, and data collection.

The staff concluded that there was insufficient information in the LRA for this program element. By letter dated July 9, 2008, the staff issued RAI B.2.48-1 asking the applicant to provide more details of the types of inspections that will be conducted. Specifically, the staff asked the applicant to provide the method used to inspect, the frequency of inspections, and the type of

data collected. By letter dated August 8, 2008, the applicant responded to RAI B.2.48-1 and it is discussed under the "parameters monitored or inspected" program element.

The staff finds this program element acceptable because it is a condition monitoring program that uses inspection techniques to identify loss of material and the response to the RAI gives adequate details of the inspection techniques.

In its letter dated October 21, 2008, in response to the NRC regional inspection of the LRA, the applicant included an enhancement in the "detection of aging effects" program element to add requirements to have inspections performed by qualified personnel using VT-3 or equivalent inspection methods, and to document and trend inspection results.

The staff finds the enhancement acceptable because the applicant has provided qualifications of personnel performing the visual inspections.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

Monitoring and Trending. LRA Section B.2.48 states that "this is a condition monitoring program that uses visual inspections to identify internal degradation of turbine casings. The observation of significant, unusual, or unexpected casing degradation is noted and is followed up by writing a condition report. The condition report may result in a condition assessment or further inspection. The disposition of the condition may result in a change in the frequency of inspection."

The SRP-LR Section A.1 2 3.5 states that: "Monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions. Plant-specific and/or industry-wide OE may be considered in evaluating the appropriateness of the technique and frequency."

The staff finds that the "monitoring and trending" program element is acceptable because, in response to RAI B.2.48-1, the applicant has supplied sufficient detail for the staff to find that monitoring and trending activities have been described and any significant degradation will result in a condition assessment that will determine if more frequent inspections are required.

In its letter dated October 21, 2008, in response to the NRC regional inspection of the LRA, the applicant included an enhancement in the "monitoring and trending" program element to add requirements to have inspections performed by qualified personnel using VT-3 or equivalent inspection methods, and to document and trend inspection results.

The staff finds the enhancement acceptable because the applicant has indicated that qualified personnel will document and trend inspection results, which make the "monitoring and trending" program element, satisfy the criterion defined in SRP-LR Section A.1.2.3.5

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

Acceptance Criteria. LRA Section B.2.48 states that the acceptance criteria for this program are no unacceptable visual indications of wall-thinning or loss of material. The applicant further stated that unacceptable in this program involves a determination by engineering evaluation

that the components are degraded to the point that they may not be capable of performing their intended function until the next scheduled inspection.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6 which states that the acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the structure and component intended function(s) are maintained under all CLB design conditions during the period of extended operation and the program should include a methodology for analyzing the results against applicable acceptance criteria.

In its letter dated October 21, 2008, in response to the NRC regional inspection of the LRA, the applicant included an enhancement in the "acceptance criteria" program element to establish specific acceptance criteria for inspection results, similar to those of ASME Section XI, IWB 3519.1, used for pump casing inspection.

The staff finds the enhancement acceptable because specific acceptance criteria are identified in addition to the engineering evaluation for determining the extent of age related degradation.

The staff finds the "acceptance criteria" program element acceptable because the applicant has identified the acceptance criteria and will use engineering evaluation to determine the extent of degradation and the need for corrective action.

The staff finds that the "acceptance criteria" program element is acceptable because it satisfies the recommendations in the SRP-LR Section A.1.2.3.6-1.

Operating Experience. The applicant stated in LRA Section B.2.48 that a search of plant-specific OE for the most recent five-year period, no loss of pressure boundary integrity was identified that could be attributed to the applicable aging effects in the scope of this program.

The staff reviewed the applicant's "operating experience" program element against the criteria in SRP LR Section A.1.2.3.10, which states that OE with existing programs should be discussed. The OE of AMPs, including past corrective actions resulting in program enhancements or additional programs, should be considered.

The staff reviewed the applicant's OE described in LRA Section B.2.48. The applicant stated that this program is consistent with industry practice and has proven effective in maintaining the material condition of the RCIC and HPCI pump turbine casings.

By letter dated July 9, 2008, the staff issued RAI B.2.48-2 asking the applicant to provide more information concerning the statement in the LRA that stated, "The elements that comprise the Preventive Maintenance Activities – RCIC/HPCI Turbine Casings program are consistent with industry practice and have proven effective in maintaining the material condition of the RCIC and HPCI pump turbines, including casings." The staff asked for details on the industry practice. The staff also asked for a justification explaining how a monitoring program can maintain the material condition of the RCIC and HPCI pump turbines and whether visual inspections can be used to stop loss of material.

By letter dated August 8, 2008, the applicant responded stating that industry practice is to perform periodic disassembly and inspection of the turbines in accordance with vendor recommendations contained in the vender instruction manual. The applicant went on to state

that visual inspection provides an indication of the material condition and is not intended to prevent the effects of aging.

The applicant amended the "detection of aging effects" program element to include the following:

> The program relies on visual inspection to identify surface degradation. Inspections are performed on a nominal 10-year frequency based on past inspections and on industry experience.

The applicant amended the "operating experience" program element to say:

> The elements that comprise the Preventive Maintenance Activities – RCIC/HPCI Turbine Casings are based on manufacturing recommendations and with industry guidance and have proven effective in managing the material condition of the RCIC and HPCI pump turbines, including the casings.

The staff reviewed the response and finds that it satisfactorily addresses the RAI.

The staff confirmed that the "operation experience" program element satisfies the criterion defined in SPR-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.2.39 and Commitment No. 42 in Table A-1, the applicant provided the UFSAR supplement for the Preventive Maintenance Activities – RCIC/HPCI Turbine Casings Program. The staff reviewed this section and determined that the information in the UFSAR Supplement does not provide an adequate summary description of the program consistent with the SRP-LR.

By letter dated July 9, 2008, the staff issued RAI B.2.48-1 asking the applicant to provide more details of the types of inspections that will be conducted. Specifically, the staff asked the applicant to provide the method used to inspect, the frequency of inspections, and the type of data collected. By letter dated August 8, 2008, in response to RAI B.2.48-1, the applicant responded that the inspection of RCIC and HPCI pump turbine internals, including the casings, is a skill-based visual inspection performed by Mechanical Maintenance personnel. The inspection follows SSES procedures and includes inspections for loose parts, mechanical damage, corrosion, erosion, pitting, scare deposits, and other abnormal wear. In its letter dated October 21, 2008, in response to the NRC regional inspection of the LRA, the applicant revised the UFSAR supplement to include the following three enhancements:

- A specific step to perform a visual inspection of the RCIC turbine casing
- Performance of inspections by qualified personnel using VT-3 or equivalent inspection methods, and to document and trend inspection results
- Specific acceptance criteria for inspections

The applicant has revised Commitment No. 42 to include these commitments.

Based on acceptable responses to the RAI and on the amendment to the UFSAR supplement in terms of the revision to the commitment list, the staff finds the UFSAR supplement is acceptable.

The staff determines that the information in the UFSAR Supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. The staff finds the applicant's Preventive Maintenance Activities – RCIC/HPCI Turbine Casings Program acceptable on the basis of its review as discussed above. The staff finds that the program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.4 Preventive Maintenance Activities – Main Turbine Casing

Summary of Technical Information in the Application. In its letter dated June 30, 2008, and September 26, 2008, the applicant added a plant-specific existing program, Section B.2.49, "Preventive Maintenance Activities – Main Turbine Casing," with an enhancement.

The applicant stated that the Preventive Maintenance Activities – Main Turbine Casing will manage loss of material due to FAC on the internal surfaces of the high pressure casing for the main turbine.

Staff Evaluation. The staff reviewed the Preventive Maintenance Activities – Main Turbine Casing Program against the AMP elements found in the GALL Report, SRP-LR Section A.1.2.3, and SRP-LR Table A.1-1, focusing its review on how the program manages aging effects through the effective incorporation of 10 elements (i.e., "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" program elements are part of the LRA Section B.1.3, Quality Assurance Program and Administrative Controls. The staff's evaluation of LRA Section B.1.3 program is discussed in SER Section 3.0.4. The remaining seven elements are discussed below.

Enhancement. In LRA Section B.2.49, the applicant identified an enhancement to the program to specify that the inspection of the high pressure turbine shell will consist of a visual inspection (VT-3 or equivalent) and an ultrasonic examination for wall thickness.

The staff reviewed the enhancement and determined that implementation of the enhancement will add the inspection techniques necessary to adequately manage the aging effects of loss of material due to FAC during the period of extended operation. As stated in "detection of aging effects" program element below, visual inspection will be performed to detect any age related degradation and if detected, ultrasonic inspection will be performed to determine the extent of the degradation. Based on the review, the staff finds the enhancement acceptable.

Scope of Program. In LRA Section B.2.49, the applicant stated that this program is credited for managing loss of material due to FAC on the internal carbon steel surfaces of the high pressure casing for the main turbine that is exposed to steam during normal plant operation.

The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the specific program necessary for license renewal

should be identified. The scope of the program should include the specific structures and components of which the program manages the aging.

The staff concludes that since the applicant has identified the components for which this program manages aging. The staff confirmed that the "scope of program" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

Preventive Actions. In LRA Section B.2.49, the applicant stated that no actions are taken to prevent aging effects or to mitigate age-related degradation.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that for condition or performance monitoring programs, they do not rely on preventive actions and thus, this information need not be provided.

Since this is a condition monitoring program, the staff concludes that this program does not rely on preventive actions. The staff confirmed that the "preventive actions" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.2.The staff finds this program element acceptable.

Parameters Monitored or Inspected. In LRA Section B.2.49, the applicant stated that the program inspects the internal carbon steel surfaces of the high pressure turbine casing for signs of degradation that might be indicative of wall-thinning or loss of material. Inspections will consist of a combination of visual examination and non-destructive testing.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that for a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects.

Since this is a condition monitoring program, the applicant has appropriately identified the parameter to be inspected and the method of inspection. The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

Detection of Aging Effects. In LRA section B.2.49, the applicant stated that the program will rely on established NDE techniques, including visual (VT-3 or equivalent) inspection of accessible surfaces and ultrasonic inspections of selected locations by qualified personnel to identify surface degradation and wall thickness. Inspections are performed on a nominal 10-year (12-year maximum) frequency based on manufacturer recommendation.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that the parameters to be monitored or inspected should be appropriate to ensure that the structure and component intended function(s) will be adequately maintained for license renewal under all CLB design conditions. This includes aspects such as method or technique (e.g., visual, volumetric, surface inspection), frequency, sample size, data collection and timing of new/one-time inspections to ensure timely detection of aging effects.

The staff reviewed the operating experience provided by the applicant and noted that based on significant modification work performed on the high pressure turbines during the last five years, no indication of pressure boundary wear was found on the high pressure turbine outer casing. The staff finds that based on plant operating experience, the frequency of once every ten years based on manufacturer's recommendation is acceptable. If visual inspection identifies aging degradation, ultrasonic inspection will be performed to determine the extent of the degradation.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

Monitoring and Trending. In LRA Section B.2.49, the applicant stated that this program is a condition monitoring program that is performed by qualified individuals at established intervals through a combination of visual inspection and ultrasonic testing. The applicant further stated that if during the inspection, significant or unusual or unexpected casing deterioration is observed, it will be documented on a CR; and based on analysis, the CR may result in further inspection or change in frequency.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions. Plant-specific and/or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency.

During the review process, the staff determined that monitoring and trending is not described in enough detail to allow an assessment of the predictability of the extent of degradation. As a result, the staff issued RAI B.2.49-1, by letter dated July 23, 2008, requesting the applicant to provide details describing the methods to assess remaining component life for loss of material using inspection results such that timely mitigative action can be made.

In its letter dated August 22, 2008, in response to RAI B.2.49-1 the applicant stated that the inspection is conducted to evaluate the condition of the internal surfaces of the turbine casing and looks for indications of erosion, and should erosion be detected the condition would be evaluated under the corrective action program, which would determine the margin to minimum wall thickness, acceptability of current condition and future actions including further monitoring and trending. The applicant also stated that the inspection and evaluation of the results are performed in conjunction with the equipment vendor representative who is present during the inspections. Furthermore, the results of the latest inspections conducted in 2003 and 2004, after 20 years of service, found no signs of erosion and the casings were in excellent condition.

The staff reviewed the applicant's response and noted that enough information is provided to conclude that the applicant would appropriately identify the degraded condition, and if found, it would be evaluated along with the need for further monitoring and trending. On this basis, the staff finds the response acceptable.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

Acceptance Criteria. In LRA Section B.2.49, the applicant stated that any indications or relevant conditions of degradation will be evaluated. The inspection observations will be compared to

predetermined acceptance criteria. Inspection results that do not meet the acceptance criteria will be entered into the corrective action program for evaluation.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the structure and component intended function(s) are maintained under all CLB design conditions during the period of extended operation. The program should include a methodology for analyzing the results against applicable acceptance criteria.

The applicant did not provide specific acceptance criteria or its basis such as comparison to design minimum wall or manufacturer suggested minimum wall in order to provide the basis for evaluation. The staff issued RAI B.2.49-2 by letter dated July 23, 2008, requesting the applicant to provide more details on how acceptance criteria will be established.

In its letter dated August 22, 2008, in response to RAI B.2.49-2, the applicant stated that the inspection is conducted to evaluate the condition of the internal surfaces of the turbine casing and looks for indications of erosion; and should erosion be detected the condition would be evaluated under the corrective action program, which would determine the margin to minimum wall thickness, acceptability of current condition and future actions including further monitoring and trending. The applicant also stated that the inspection and evaluation of the results rely on industry experience with the turbine equipment and are performed in conjunction with the equipment vendor representative who is present during the inspections. Furthermore, the results of the latest inspections conducted in 2003 and 2004, after 20 years of service, found no signs of erosion and the casings were in excellent condition.

The staff reviewed the applicant's response and noted that enough information is provided to conclude that the applicant would appropriately identify the degraded condition, and if found, it would evaluate the need for further corrective action. Since the inspections are conducted in the presence of the equipment vendor representative, an appropriate technical review will be performed on the inspection results. On this basis, the staff finds the response acceptable.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

Operating Experience. In LRA Section B.2.49, the applicant stated that a review of plant OE for the most recent five-year period did not reveal any age-related degradation for the main turbine casing. The applicant further stated that both high pressure turbines have been the object of significant modifications and the work associated with these modifications revealed no indication of pressure boundary wear on the high pressure turbine outer casing.

The staff reviewed the applicant's "operating experience" program element against the criteria in SRP-LR Section A.1.2.3.10, which states that OE with existing programs should be discussed. The OE of AMPs, including past corrective actions resulting in program enhancements or additional programs, should be considered.

The staff reviewed the OE provided by the applicant to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In its letter dated September 26, 2008, the applicant provided the UFSAR supplement Section A.2.1.50, for the Preventive Maintenance Activities – Main Turbine Casing Program. The applicant added Commitment No. 57 to enhance the program to add the inspection techniques. The staff reviewed this section and determines that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Preventive Maintenance Activities – Main Turbine Casing Program, including the applicant's responses to the RAIs and the enhancement, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

3.0.4.1 Summary of Technical Information in the Application

In Sections A.1.2, "Aging Management Program and Activities," and B.1.3, "Quality Assurance Program and Administrative Controls," of the license renewal application (LRA), the applicant described the elements of corrective action, confirmation process, and administrative controls that are applied to the AMPs for both safety-related (SR) and nonsafety-related components. The SSES Operational Quality Assurance (OQA) Program is used which includes the elements of corrective action, confirmation process, and administrative controls. Corrective actions, confirmation, and administrative controls are applied in accordance with the OQA Program regardless of the safety classification of the components. Specifically, in Section A.1.2 and Section B.1.3, respectively, the applicant stated that the QA Program implements the requirements of 10 CFR Part 50, Appendix B, and is consistent with NUREG-1800, "Standard Review Plan for Review of license Renewal Applications for Nuclear Power Plants."

3.0.4.2 Staff Evaluation

Pursuant to 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation. NUREG-1800, Branch Technical Position RLSB-1, "Aging Management Review - Generic," describes 10 attributes of an acceptable AMP. Three of these ten attributes are associated with the QA activities of corrective action, confirmation process, and administrative control. Table A.1-1, "Elements of an Aging Management Program for license Renewal," of Branch Technical Position RLSB-1 provides the following description of these quality attributes:

- Corrective actions, including root cause determination and prevention of recurrence, should be timely;

- The confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective; and,
- Administrative controls should provide a formal review and approval process.

NUREG-1800, Branch Technical Position IQMB-1 noted that those aspects of the AMP that affect quality of safety-related SSCs are subject to the QA requirements of Appendix B to 10 CFR Part 50. Additionally, for nonsafety-related SCs subject to an AMR, the applicant's existing Appendix B to 10 CFR Part 50 QA program may be used to address the elements of corrective action, confirmation process, and administrative control. Branch Technical Position IQMB-1 provides the following guidance with regard to the QA attributes of AMPs:

> Safety-related SCs are subject to Appendix B to 10 CFR Part 50 requirements which are adequate to address all quality related aspects of an AMP consistent with the CLB of the facility for the period of extended operation. For nonsafety-related SCs that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its Appendix B to 10 CFR Part 50 program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d).

The NRC staff reviewed the applicant's AMPs described in Appendix A, "Final Safety Analysis Report Supplement," and Appendix B, "Aging Management Programs," of the LRA, and the associated implementing documents. The purpose of this review was to ensure that the quality assurance attributes (corrective action, confirmation process, and administrative controls) were consistent with the staff's guidance described in NUREG-1800, Section A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)." Based on the NRC staff's evaluation, the descriptions of the AMPs and their associated quality attributes provided in Appendix A, Section A.1.2, and Appendix B, Section B.1.3, of the LRA are consistent with the staff's position regarding quality assurance for aging management.

3.0.4.3 Conclusion

On the basis of the NRC staff's evaluation, the staff concludes that the descriptions and applicability of the plant-specific AMPs and their associated quality attributes provided in Appendix A, Section A.1.2, and Appendix B, Section B.1.3 and Section B.2, of the LRA, are consistent with the staff's position regarding QA for aging management. The staff concludes that the QA attributes (corrective action, confirmation process, and administrative control) of the applicant's AMPs are consistent with 10 CFR 54.21(a)(3).

3.1 Aging Management of Reactor Vessel, Internals, and Reactor Coolant System

This section of the SER documents the staff's review of the applicant's AMR results for the RV, RV internals, and reactor coolant system components and component groups of:

- Reactor Pressure Vessel
- Reactor Vessel Internals
- Reactor Coolant System Pressure Boundary

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the RV, RV internals, and reactor coolant system components and component groups. LRA Table 3.1.1, "Summary of Aging Management Programs for Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL Report," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the RV, RV internals, and reactor coolant system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry OE in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry OE included a review of the GALL Report and OE issues identified since the issuance of the GALL Report.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the RV, RV internals, and reactor coolant system components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.1.2.1.

In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.1.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.1.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.1.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's OE to verify the applicant's claims.

Table 3.1-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.1 and addressed in the GALL Report.

Table 3.1-1 Staff Evaluation for Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel pressure vessel support skirt and attachment welds (3.1.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel alloy or stainless steel cladding; nickel alloy RV components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel alloy or stainless steel cladding; nickel alloy RCPB piping, piping components, and piping elements exposed to reactor coolant (3.1.1-3)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel pump and valve closure bolting (3.1.1-4)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) check Code limits for allowable cycles (less than 7000 cycles) of thermal stress range	Yes	Not applicable	Not applicable to SSES. (See SER Section 3.1.2.2.1)
Stainless steel and nickel alloy RV internals components (3.1.1-5)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Nickel Alloy tubes and sleeves in a reactor coolant and secondary FW/steam environment (3.1.1-6)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel RCPB closure bolting, head closure studs, support skirts and attachment welds, pressurizer relief tank components, steam generator components, piping and components external surfaces and bolting (3.1.1-7)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.1)
Steel; stainless steel; and nickel alloy RCPB piping, piping components, piping elements; flanges; nozzles and safe ends; pressurizer vessel shell heads and welds; heater sheaths and sleeves; penetrations; and thermal sleeves (3.1.1-8)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel alloy or stainless steel cladding; nickel alloy RV components: flanges; nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-9)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel alloy or stainless steel cladding; nickel alloy steam generator components (flanges; penetrations; nozzles; safe ends, lower heads and welds) (3.1.1-10)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant (3.1.1-11)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22), or BWR Water Chemistry Program (B.2.2) and ISI Program (B.2.1)	Consistent with GALL Report (See SER Section 3.1.2.2.2.1)
Steel steam generator shell assembly exposed to secondary FW and steam (3.1.1-12)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.2.1)
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-13)	Loss of material due to general (steel only), pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.2.2)
Stainless steel, nickel alloy, and steel with nickel alloy or stainless steel cladding RV flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds (3.1.1-14)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22), or BWR Water Chemistry Program (B.2.2) and ISI Program (B.2.1), or BWR Water Chemistry Program (B.2.2) and BWR Vessel Internals Program (B.2.9)	Consistent with GALL Report (See SER Section 3.1.2.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel; steel with nickel alloy or stainless steel cladding; and nickel alloy RCPB components exposed to reactor coolant (3.1.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22), or BWR Water Chemistry Program (B.2.2) and ISI Program (B.2.1)	Consistent with GALL Report (See SER Section 3.1.2.2.2.3)
Steel steam generator upper and lower shell and transition cone exposed to secondary FW and steam (3.1.1-16)	Loss of material due to general, pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry and, for Westinghouse Model 44 and 51 S/G, if general and pitting corrosion of the shell is known to exist, additional inspection procedures are to be developed.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.2.4)
Steel (with or without stainless steel cladding) RV beltline shell, nozzles, and welds (3.1.1-17)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with 10 CFR Part 50, Appendix G, and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations.	Yes	TLAA	Loss of fracture toughness is a TLAA (See SER Section 3.1.2.2.3.1)
Steel (with or without stainless steel cladding) RV beltline shell, nozzles, and welds; safety injection nozzles (3.1.1-18)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor Vessel Surveillance	Yes	Reactor Vessel Surveillance Program (B.2.21)	Consistent with GALL Report (See SER Section 3.1.2.2.3.2)
Stainless steel and nickel alloy top head enclosure vessel flange leak detection line (3.1.1-19)	Cracking due to SCC and IGSCC	A plant-specific aging management program is to be evaluated.	Yes	BWR Water Chemistry Program (B.2.2) and Small Bore Class 1 Piping Inspection (B.2.31)	Consistent with GALL Report (See SER Section 3.1.2.2.4.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel isolation condenser components exposed to reactor coolant (3.1.1-20)	Cracking due to SCC and IGSCC	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes	Not applicable	See SER Section 3.1.2.2.4.2
Reactor vessel shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process (3.1.1-21)	Crack growth due to cyclic loading	TLAA	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.5)
Stainless steel and nickel alloy RV internals components exposed to reactor coolant and neutron flux (3.1.1-22)	Loss of fracture toughness due to neutron irradiation embrittlement, void swelling	UFSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.6)
Stainless steel RV closure head flange leak detection line and bottom-mounted instrument guide tubes (3.1.1-23)	Cracking due to SCC	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.7.1)
Class 1 CASS piping, piping components, and piping elements exposed to reactor coolant (3.1.1-24)	Cracking due to SCC	Water Chemistry and, for CASS components that do not meet the NUREG-0313 guidelines, a plant-specific AMP	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.7.2)
Stainless steel jet pump sensing line (3.1.1-25)	Cracking due to cyclic loading	A plant-specific aging management program is to be evaluated.	Yes	BWR Water Chemistry Program (B.2.2) and Small Bore Class 1 Piping Inspection (B.2.31)	Consistent with GALL Report (See SER Section 3.1.2.2.8.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-26)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD) and plant-specific verification program	Yes	Not applicable	See SER Section 3.1.2.2.8.2
Stainless steel and nickel alloy RV internals screws, bolts, tie rods, and hold-down springs (3.1.1-27)	Loss of preload due to stress relaxation	UFSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.9)
Steel steam generator FW impingement plate and support exposed to secondary FW (3.1.1-28)	Loss of material due to erosion	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.10)
Stainless steel steam dryers exposed to reactor coolant (3.1.1-29)	Cracking due to flow-induced vibration	A plant-specific aging management program is to be evaluated.	Yes	BWR Vessels Internals (B.2.9),	Consistent with GALL Report (See SER Section 3.1.2.2.11)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel RV internals components (e.g., Upper internals assembly, RCCA guide tube assemblies, Baffle/former assembly, Lower internal assembly, shroud assemblies, Plenum cover and plenum cylinder, Upper grid assembly, Control rod guide tube (CRGT) assembly, Core support shield assembly, Core barrel assembly, Lower grid assembly, Flow distributor assembly, Thermal shield, Instrumentation support structures) (3.1.1-30)	Cracking due to SCC, IASCC	Water Chemistry and UFSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.12)
Nickel alloy and steel with nickel alloy cladding piping, piping component, piping elements, penetrations, nozzles, safe ends, and welds (other than RV head); pressurizer heater sheaths, sleeves, diaphragm plate, manways and flanges; core support pads/core guide lugs (3.1.1-31)	Cracking due to primary water SCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and UFSAR supplement commitment to implement applicable plant commitments to (1) NRC Orders, Bulletins, and Generic Letters associated with nickel alloys and (2) staff-accepted industry guidelines.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.13)
Steel steam generator FW inlet ring and supports (3.1.1-32)	Wall thinning due to FAC	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.14)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel alloy RV internals components (3.1.1-33)	Changes in dimensions due to void swelling	UFSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.15)
Stainless steel and nickel alloy reactor CRD head penetration pressure housings (3.1.1-34)	Cracking due to SCC and primary water SCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and for nickel alloy, comply with applicable NRC Orders and provide a commitment in the UFSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.16.1)
Steel with stainless steel or nickel alloy cladding primary side components; steam generator upper and lower heads, tubesheets and tube-to-tube sheet welds (3.1.1-35)	Cracking due to SCC and primary water SCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and for nickel alloy, comply with applicable NRC Orders and provide a commitment in the UFSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.16.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy, stainless steel pressurizer spray head (3.1.1-36)	Cracking due to SCC and primary water SCC	Water Chemistry and One-Time Inspection and, for nickel alloy welded spray heads, comply with applicable NRC Orders and provide a commitment in the UFSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.16.2)
Stainless steel and nickel alloy RV internals components (e.g., Upper internals assembly, RCCA guide tube assemblies, Lower internal assembly, CEA shroud assemblies, Core shroud assembly, Core support shield assembly, Core barrel assembly, Lower grid assembly, Flow distributor assembly) (3.1.1-37)	Cracking due to SCC, primary water SCC, IASCC	Water Chemistry and UFSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	No	Not applicable	Not applicable to BWRs (See SER Section 3.1.2.2.17)
Steel (with or without stainless steel cladding) CRD return line nozzles exposed to reactor coolant (3.1.1-38)	Cracking due to cyclic loading	BWR Control Rod Drive Return Line Nozzle	No	BWR CRD Return Line Nozzle (B.2.6)	Consistent with GALL Report
Steel (with or without stainless steel cladding) FW nozzles exposed to reactor coolant (3.1.1-39)	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	BWR Feedwater Nozzle (B.2.5)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel alloy penetrations for CRD stub tubes instrumentation, jet pump instrumentation, SLC, flux monitor, and drain line exposed to reactor coolant (3.1.1-40)	Cracking due to SCC, IGSCC, cyclic loading	BWR Penetrations and Water Chemistry	No	BWR Penetrations (B.2.8), BWR Water Chemistry (B.2.2)	Consistent with GALL Report
Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds (3.1.1-41)	Cracking due to SCC and IGSCC	BWR Stress Corrosion Cracking and Water Chemistry	No	BWR Stress Corrosion Cracking (B.2.7), BWR Water Chemistry (B.2.2)	Consistent with GALL Report
Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant (3.1.1-42)	Cracking due to SCC and IGSCC	BWR Vessel ID Attachment Welds and Water Chemistry	No	BWR Vessel ID Attachment Welds (B.2.9), BWR Water Chemistry (B.2.2)	Consistent with GALL Report
Stainless steel fuel supports and CRD assemblies CRD housing exposed to reactor coolant (3.1.1-43)	Cracking due to SCC and IGSCC	BWR Vessel Internals and Water Chemistry	No	BWR Vessel Internals (B.2.9), BWR Water Chemistry (B.2.2), Inservice Inspection (B.2.1)	Consistent with GALL Report
Stainless steel and nickel alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, CRD housing, nuclear instrumentation guide tubes (3.1.1-44)	Cracking due to SCC, IGSCC, IASCC	BWR Vessel Internals and Water Chemistry	No	BWR Vessel Internals (B.2.9), BWR Water Chemistry (B.2.2)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-45)	Wall thinning due to FAC	Flow-Accelerated Corrosion	No	Flow-Accelerated Corrosion Program (B.2.11)	Consistent with GALL Report
Nickel alloy core shroud and core plate access hole cover (mechanical covers) (3.1.1-46)	Cracking due to SCC, IGSCC, IASCC	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to SSES (See SER Section 3.1.2.1.1)
Stainless steel and nickel alloy RV internals exposed to reactor coolant (3.1.1-47)	Loss of material due to pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not Applicable	Addressed under item 3.1.1-14 (See SER Section 3.1.2.1.1)
Steel and stainless steel Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-48)	Cracking due to SCC, IGSCC (for stainless steel only), and thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	Inservice Inspection (ISI) Program (B.2.1), BWR Water Chemistry Program (B.2.2), and Small Bore Class 1 Piping Inspection (B.2.31), or Inservice Inspection (ISI) Program (B.2.1) and Small Bore Class 1 Piping Inspection (B.2.31)	Consistent with GALL Report (See SER Section 3.1.2.1.2.)
Nickel alloy core shroud and core plate access hole cover (welded covers) (3.1.1-49)	Cracking due to SCC, IGSCC, IASCC	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and, for BWRs with a crevice in the access hole covers, augmented inspection using UT or other demonstrated acceptable inspection of the access hole cover welds	No	Inservice Inspection (B.2.1), BWR Water Chemistry (B.2.2)	Consistent with GALL Report Access hole covers do not have a crevice

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
High-strength low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage (3.1.1-50)	Cracking due to SCC and IGSCC	Reactor Head Closure Studs	No	Reactor Head Closure Studs Program (B.2.3)	Consistent with GALL Report
Cast austenitic stainless steel jet pump assembly castings; orificed fuel support (3.1.1-51)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Thermal Aging and Neutron Irradiation Embrittlement of CASS (B.2.10)	Consistent with GALL Report
Steel and stainless steel RCPB (RCPB) pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature systems (3.1.1-52)	Cracking due to SCC, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-53)	Loss of material due to general, pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.1.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-54)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.1.2.1.1)
Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant > 250°C (> 482°F) (3.1.1-55)	Loss of fracture toughness due to thermal aging embrittlement	Inservice Inspection (IWB, IWC, and IWD). Thermal aging susceptibility screening is not necessary, ISI requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	Inservice Inspection (ISI) Program (B.2.1) Small Bore Class 1 Piping Inspection (B.2.31)	Consistent with GALL Report (See SER Section 3.1.2.1.3.)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy > 15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-56)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to SSES (See SER Section 3.1.2.1.1)
Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and CRD pressure housings exposed to reactor coolant > 250°C (> 482°F) (3.1.1-57)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not Applicable	Not Applicable (See SER Section 3.1.2.1.1)
Steel RCPB external surfaces exposed to air with borated water leakage (3.1.1-58)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Not applicable	Not applicable to BWRs
Steel steam generator steam nozzle and safe end, FW nozzle and safe end, AFW nozzles and safe ends exposed to secondary FW/steam (3.1.1-59)	Wall thinning due to FAC	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to BWRs
Stainless steel flux thimble tubes (with or without chrome plating) (3.1.1-60)	Loss of material due to wear	Flux Thimble Tube Inspection	No	Not applicable	Not applicable to BWRs
Stainless steel, steel pressurizer integral support exposed to air with metal temperature up to 288°C (550°F) (3.1.1-61)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD)	No	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, steel with stainless steel cladding reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings exposed to reactor coolant (3.1.1-62)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD)	No	Not applicable	Not applicable to BWRs
Steel RV flange, stainless steel and nickel alloy RV internals exposed to reactor coolant (e.g., upper and lower internals assembly, CEA shroud assembly, core support barrel, upper grid assembly, core support shield assembly, lower grid assembly) (3.1.1-63)	Loss of material due to wear	Inservice Inspection (IWB, IWC, and IWD)	No	Not applicable	Not applicable to BWRs
Stainless steel and steel with stainless steel or nickel alloy cladding pressurizer components (3.1.1-64)	Cracking due to SCC, primary water SCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry	No	Not applicable	Not applicable to BWRs
Nickel alloy RV upper head and CRD penetration nozzles, instrument tubes, head vent pipe (top head), and welds (3.1.1-65)	Cracking due to primary water SCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and nickel alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of PWRs	No	Not applicable	Not applicable to BWRs
Steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam (3.1.1-66)	Loss of material due to erosion	Inservice Inspection (IWB, IWC, and IWD) for Class 2 components	No	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel with stainless steel or nickel alloy cladding; or stainless steel pressurizer components exposed to reactor coolant (3.1.1-67)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to BWRs
Stainless steel, steel with stainless steel cladding Class 1 piping, fittings, pump casings, valve bodies, nozzles, safe ends, manways, flanges, CRD housing; pressurizer heater sheaths, sleeves, diaphragm plate; pressurizer relief tank components, reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings (3.1.1-68)	Cracking due to SCC	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to BWRs
Stainless steel, nickel alloy safety injection nozzles, safe ends, and associated welds and buttering exposed to reactor coolant (3.1.1-69)	Cracking due to SCC, primary water SCC	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to BWRs
Stainless steel; steel with stainless steel cladding Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-70)	Cracking due to SCC, thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	Not applicable	Not applicable to BWRs
High-strength low alloy steel closure head stud assembly exposed to air with reactor coolant leakage (3.1.1-71)	Cracking due to SCC; loss of material due to wear	Reactor Head Closure Studs	No	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy steam generator tubes and sleeves exposed to secondary FW/steam (3.1.1-72)	Cracking due to OD SCC and intergranular attack, loss of material due to fretting and wear	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BWRs
Nickel alloy steam generator tubes, repair sleeves, and tube plugs exposed to reactor coolant (3.1.1-73)	Cracking due to primary water SCC	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BWRs
Chrome plated steel, stainless steel, nickel alloy steam generator anti-vibration bars exposed to secondary FW/steam (3.1.1-74)	Cracking due to SCC, loss of material due to crevice corrosion and fretting	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BWRs
Nickel alloy once-through steam generator tubes exposed to secondary FW/steam (3.1.1-75)	Denting due to corrosion of carbon steel tube support plate	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BWRs
Steel steam generator tube support plate, tube bundle wrapper exposed to secondary FW/steam (3.1.1-76)	Loss of material due to erosion, general, pitting, and crevice corrosion, ligament cracking due to corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BWRs
Nickel alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary FW/steam (3.1.1-77)	Loss of material due to wastage and pitting corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BWRs
Steel steam generator tube support lattice bars exposed to secondary FW/steam (3.1.1-78)	Wall thinning due to FAC	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy steam generator tubes exposed to secondary FW/steam (3.1.1-79)	Denting due to corrosion of steel tube support plate	Steam Generator Tube Integrity; Water Chemistry and, for plants that could experience denting at the upper support plates, evaluate potential for rapidly propagating cracks and then develop and take corrective actions consistent with NRC Bulletin 88-02.	No	Not applicable	Not applicable to BWRs
Cast austenitic stainless steel RV internals (e.g., upper internals assembly, lower internal assembly, CEA shroud assemblies, control rod guide tube assembly, core support shield assembly, lower grid assembly) (3.1.1-80)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Not applicable	Not applicable to BWRs
Nickel alloy or nickel alloy clad steam generator divider plate exposed to reactor coolant (3.1.1-81)	Cracking due to primary water SCC	Water Chemistry	No	Not applicable	Not applicable to BWRs
Stainless steel steam generator primary side divider plate exposed to reactor coolant (3.1.1-82)	Cracking due to SCC	Water Chemistry	No	Not applicable	Not applicable to BWRs
Stainless steel; steel with nickel alloy or stainless steel cladding; and nickel alloy RV internals and RCPB components exposed to reactor coolant (3.1.1-83)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy steam generator components such as, secondary side nozzles (vent, drain, and instrumentation) exposed to secondary FW/steam (3.1.1-84)	Cracking due to SCC	Water Chemistry and One-Time Inspection or Inservice Inspection (IWB, IWC, and IWD).	No	Not applicable	Not applicable to BWRs
Nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.1.1-85)	None	None	No	None	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (External); air with borated water leakage; concrete; gas (3.1.1-86)	None	None	No	None	Consistent with GALL Report
Steel piping, piping components, and piping elements in concrete (3.1.1-87)	None	None	No	Not applicable	Not applicable to SSES (See SER Section 3.1.2.1.1)

The staff's review of the RV, RV internals, and reactor coolant system component groups followed any one of several approaches. One approach, documented in SER Section 3.1.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.1.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.1.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the RV, RV internals, and reactor coolant system components is documented in SER Section 3.0.3.

3.1.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.1.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the RV, RV internals, and reactor coolant system components:

- Inservice Inspection (ISI) Program
- BWR Water Chemistry Program
- Reactor Head Closure Studs Program
- BWR Vessel ID Attachment Welds Program
- BWR Feedwater Nozzle Program
- BWR CRD Return Line Nozzle Program
- BWR Stress Corrosion Cracking (SCC) Program
- BWR Penetrations Program
- BWR Vessel Internals Program
- Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Flow-Accelerated Corrosion (FAC) Program
- Bolting Integrity Program
- Closed Cooling Water Chemistry Program
- Reactor Vessel Surveillance Program
- Small Bore Class 1 Piping Inspection
- System Walkdown Program
- Inservice Inspection (ISI) Program - IWF

LRA Tables 3.1.2-1 through 3.1.2-3 summarize AMRs for the RV, RV internals, and reactor coolant system components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

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

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

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

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

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the reactor vessel, reactor vessel internals, and RCS components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.1.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsection that follows.

3.1.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.1.1, items 46, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because access hole covers are a welded design. The staff noted that the nickel alloy core shroud and core plate access hole cover is a mechanical design for item 46. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES does not have a mechanical access hole cover. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.1.1, item 47, the applicant states that the corresponding AMR result line in the GALL Report is addressesed under item 3.1.1-14. The staff reviewed the documentation supporting the applicant's AMR evaluation in items 3.1.1-14, and no AMR line items roll up to 3.1.1-47. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.1.1, items 53, 54, 56 and 87, the applicant indicates that the corresponding AMR result line in the GALL Report is not applicable because SSES does not have the components for these items. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES does not have these components. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.1-1 line item 3.1.1-57, the applicant stated that loss of fracture toughness due to thermal aging embrittlement for cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant > 250°C (> 482°F) is not applicable because these components are included in LRA Table 3.1-1 line items 3.3.1-51 and 3.1.1-55.

The staff confirmed that the components listed under line item 3.1.1-57 are included in line items 51 and 55. The applicant has proposed using the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program to manage the aging effects in line 3.1.1-51; and the Inservice Inspection, and Small Bore Class 1 Piping Inspection Programs to manage the aging effects in line 3.1.1-55. Based on this review, the staff finds that Table 3.3.1, line item 3.1.1-57 is not applicable.

3.1.2.1.2 Cracking due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking

In LRA Table 3.1.2-3, for stainless steel tubing in a treated water (reactor coolant) environment, the applicant specified use of the BWR Water Chemistry Program for managing the aging effect of cracking due to SCC or IGSCC. For this AMR result line, the applicant referred to LRA Table 3.1.1, item 3.1.1-48 and cited generic note E, indicating that the result is consistent with the GALL Report for component, material, environment and aging effect but a different AMP is used. The staff noted that for the same component, material and environment combination, the GALL report recommends use of the Inservice Inspection (IWB, IWC and IWD) Program, the Water Chemistry Program, and the One-Time Inspection of ASME Code Class 1 Small Bore Piping for managing the aging effect of cracking due to SCC or IGSCC. The staff issued RAI 3.1-4 by letter dated July 15, 2008, asking the applicant to provide technical justification that the AMP specified in the LRA provides adequate management of the aging effect during the period of extended operation.

In a letter dated August 15, 2008, the applicant responded to RAI 3.1-4 by providing the following response:

> An inspection program is needed to confirm the effectiveness of the BWR Water Chemistry Program. LRA Table 3.1.2-3 is revised to credit the ISI Program and the Small Bore Class 1 Piping Inspection in addition to the BWR Water Chemistry Program to manage cracking for stainless steel tubing in treated water. This is consistent with the combination of aging management programs identified in GALL Report Item IV.C1-1. Note A is applicable.

In LRA Table 3.1.2-3, for stainless steel condensing chambers, piping and fittings, valve bodies, and flow orifices in a treated water environment, the applicant specified use of the BWR Water Chemistry Program and the Small Bore Class 1 Piping Inspection for managing the aging effect of cracking due to SCC or IGSCC. For these AMR result lines, the applicant referred to LRA Table 3.1.1, item 3.1.1-48 and cited generic note A, indicating that the result is consistent with the GALL Report for component, material, environment, aging effect, and the AMP is consistent with the GALL Report. The staff noted that for the same or similar components and the same material and environment combination, the GALL report recommends use of the Inservice Inspection (IWB, IWC and IWD) Program, the Water Chemistry Program, and the One-Time Inspection of ASME Code Class 1 Small Bore Piping for managing the aging effect of cracking due to SCC or IGSCC. The staff issued RAI 3.1-6 by letter dated July 15, 2008, asking the applicant to provide technical justification that the applicant's recommended AMPs provide adequate management of the aging effect during the period of extended operation and justify why Note A is appropriate for these AMR results lines.

In a letter dated August 15, 2008, the applicant responded to RAI 3.1-6 by providing the following response:

> The LRA Table 3.1.2-3 AMR result lines where the components are small bore piping components made of stainless steel, the environment is "treated water (internal)," the aging effect is cracking, and the AMPs are BWR Water Chemistry Program and Small Bore Class 1 Piping Inspection are revised to also credit the ISI Program. Also, the line entry for stainless steel tubing in LRA Table 3.1-2-3 is revised to credit both the Inservice Inspection Program and the Small Bore Class 1 Piping Inspection.
>
> In total, there are 6 AMR line entries, covering stainless steel condensing chambers, flow orifices, piping and fittings <4 inch, tubing and valves exposed to treated water subject to cracking and compared to GALL Report line item IV.C1-1. By crediting ISI for these entries and ISI and small bore inspection for the tubing, the credited programs are consistent with GALL Report line item IV.C1-1. Note A is applicable.
>
> The LRA is amended to make the necessary changes.

The staff reviewed all of the LRA changes that the applicant made in response to RAIs 3.1-4 and 3.1-6. The staff confirmed that the changes brought the applicant's AMR result lines into consistency with the corresponding AMR results in the GALL Report. Because the applicant's AMR results are consistent with the GALL Report, the staff finds the LRA changes and the applicant's AMR results for LRA Table 3.1.1, Item 3.1.1-48 to be acceptable.

LRA Table 3.1.2-3 includes AMR result lines for carbon steel piping and fittings <4" nominal pipe size (NPS) and for carbon steel valves <4" NPS in an environment of treated water and with an aging effect of cracking. The applicant specified the Small Bore Class 1 Piping Inspection, only, as the AMP to manage the aging effect of cracking for these components and cites generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The staff noted that the components, material, environment and aging effect all appear to be consistent with GALL Report Item IV.C1-1, where the recommended AMPs are the ISI Program, the Water Chemistry Program, and the One-Time Inspection of ASME Class 1 Small Bore Piping. The staff issued RAI 3.1-7 by letter dated July 15, 2008, asking the applicant to explain why Note H was used

for these AMR results and to justify that the AMP specified by the applicant for these components provides satisfactory aging management during the period of extended operation, comparable to the AMPs recommended in GALL Report line IV.C1-1.

In a letter dated August 15, 2008, the applicant responded to RAI 3.1-7 by providing the following response:

> GALL Report item IV.C1-1 is appropriate for comparison in the AMR result lines in the LRA Table 3.1.2-3 for piping and fittings <4 inch and for valve bodies <4 inch, for which the material is carbon steel, the environment is "treated water (internal)," and the aging effect is cracking (due to thermal and mechanical loading).
>
> The AMR results are consistent with GALL Report item IV.C1-1 for the material (steel), environment (reactor coolant) and aging effect (cracking). The LRA is revised to credit the ISI Program, in addition to the Small Bore Class 1 Piping Inspection, to manage cracking for the components. While GALL Report item IV.C1-1 also credits Water Chemistry, it is not applicable here, since cracking due to stress corrosion is not an aging effect for steel components. Therefore, crediting ISI and Small Bore Class 1 Piping Inspection to manage cracking due to thermal and mechanical loading is considered to be consistent with the recommendations of GALL Report item IV.C1-1. However, since PPL is crediting only two of the three programs that are listed in the GALL Report item, a note E, instead of note A, is used for the comparison to the GALL Report.

The staff reviewed the applicant's response and the associated LRA changes. The staff noted that the mechanism associated with the aging effect of cracking in these components is thermal and mechanical loading, which is not strongly influenced by the water chemistry environment of the components. Because there is no mitigating effect provided by the BWR Water Chemistry Program for the aging mechanism of thermal and mechanical loading, the staff finds it acceptable for the applicant not to credit the BWR Water Chemistry Program for these components. Because the Small Bore Class 1 Piping Inspection provides for one-time volumetric inspections that are capable of finding cracking due to thermal and mechanical loading, and for piping <4 inch diameter the ISI program provides for periodic surface examinations and for VT-2 examinations for leakage at every RFO. The staff finds the applicant's LRA changes and the revised AMR results for carbon steel piping and fittings <4 inch and for carbon steel valve bodies <4 inch in an environment of treated water with the aging effect is cracking due to thermal and mechanical loading to be acceptable.

Based on the changes that the applicant made to the LRA in response to RAIs 3.1-4 and 3.1-6, the explanation provided in response to RAI 3.1-7, and the programs identified for managing the subject aging effects, the staff determines that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.1.2.1.3 Loss of Fracture Toughness due to Thermal Aging Embrittlement

In the discussion in LRA Table 3.1.1, item 3.1.1-55, the applicant stated that for CASS valve bodies less than 4 inch NPS, the Small Bore Class 1 Piping Inspection is credited to manage loss of fracture toughness. In a letter dated July 15, 2008, the staff issued RAI 3.1-5 asking the

applicant to justify use of the Small Bore Class 1 Piping Inspection for managing the loss of fracture toughness in CASS valve bodies less than 4 inch NPS, rather than using the Inservice Inspection Program as recommended in the GALL Report. In the applicant's response to RAI B.2.31-1, in letter dated July 25, 2008, which is discussed in Section 3.0.3.1.18 and the applicant's response to RAI 3.1-5 in a letter dated August 15, 2008, the applicant revised the discussion in item 3.1.1-55 to delete the statement that for CASS valve bodies less than 4 inch NPS, the Small Bore Class 1 Piping Inspection is credited to manage loss of fracture toughness. Based on this change, the applicant's Inservice Inspection Program is credited to manage loss of fracture toughness due to thermal aging embrittlement for all CASS pump casings, pump covers, thermal barriers and valve bodies exposed to reactor coolant >250°C (>482°F), including CASS valve bodies less than 4 inch NPS. This combination of components, material, environment, aging effect and aging management program is consistent with the recommendations in the GALL Report for item 3.1.1-55. On this basis, the staff finds the applicant's change in the LRA discussion for item 3.1.1-55 and the applicant's associated AMR results to be acceptable.

SER Section 3.1.2.1 Conclusion: The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent OE and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.1.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the RV, RV internals, and reactor coolant system components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of fracture toughness due to neutron irradiation embrittlement
- cracking due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC)
- crack growth due to cyclic loading
- loss of fracture toughness due to neutron irradiation embrittlement and void swelling
- cracking due to SCC
- cracking due to cyclic loading
- loss of preload due to stress relaxation
- loss of material due to erosion
- cracking due to flow-induced vibration
- cracking due to SCC and irradiation-assisted SCC

- cracking due to primary water SCC
- wall thinning due to FAC
- changes in dimensions due to void swelling
- cracking due to SCC and primary water SCC
- cracking due to SCC, primary water SCC, and irradiation-assisted SCC
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.1.2.2. The staff's review of the applicant's further evaluation follows.

3.1.2.2.1 *Cumulative Fatigue Damage*

LRA Section 3.1.2.2.1 states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.1.2.2.2 against the following criteria in SRP-LR Section 3.1.2.2.2:

(1) LRA Section 3.1.2.2.2 addresses loss of material due to general, pitting, and crevice corrosion in BWR top head and top head nozzles and PWR steam generator shell assembly. The applicant stated that the BWR Water Chemistry Program is supplemented by the ISI Program for managing loss of material due to general, pitting, and crevice corrosion for the steel RV upper head and the top head nozzles exposed to reactor coolant. A one-time inspection is not credited. The BWR Water Chemistry Program in association with the Small Bore Class 1 Piping Inspection manages loss of material due to general, pitting, and crevice corrosion for steel piping and valves less than 4 inches exposed to reactor coolant. The Small Bore Class 1 Piping Inspection is a one-time inspection. Loss of material for a steam generator shell assembly is only applicable to PWRs.

SRP-LR Section 3.1.2.2.2 states that loss of material due to general, pitting, and crevice corrosion may occur in the steel PWR steam generator shell assembly exposed to secondary FW and steam. Loss of material due to general, pitting, and crevice corrosion also may occur in the steel top head enclosure (without cladding) top head nozzles (vent, top head spray or reactor core isolation cooling (RCIC), and spare) exposed to reactor coolant. The existing program controls reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to determine

whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The staff reviewed all AMR result lines referring to LRA Table 3.1.1, item 3.1.1-11, and to LRA Section 3.1.2.2.2.1. The staff noted that the AMR results can be divided into three categories based upon the AMP proposed by the applicant: 1) AMR results where loss of material is managed by the BWR Water Chemistry Program, alone; 2) AMR results where loss of material is managed by a combination of the BWR Water Chemistry Program and the ASME Code Section XI Inservice Inspection (IWB, IWC, and IWD) program; and 3) AMR results where loss of material is managed by a combination of the BWR Water Chemistry Program and the Small Bore Class 1 Piping Inspection. For the first and second category of these AMR results, the applicant cited generic Note E indicating that the material, environment and aging effect are consistent with the GALL Report but a different aging management program is credited. For AMR results in the third category, BWR Water Chemistry Program and Small Bore Class 1 Piping Inspection, the applicant cited generic Note C indicating that the component is different, but the material, environment, aging effect, and AMP are all consistent with the GALL Report.

As a result of its review of the applicant's AMP B.2.31, Small Bore Class 1 Piping Inspection, and the applicant's AMR results, the staff issued requests for additional information in letters dated June 23, 2008, and July 15, 2008.

RAI B.2.31-1 asked the applicant to reconcile inconsistencies related to the applicant's claim that the Small Bore Class 1 Piping Inspection is consistent with GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small Bore Piping."

RAI 3.1-1 asked the applicant to justify how the BWR Water Chemistry Program, alone, would provide adequate aging management for loss of material for those AMR results where no inspection was specified to confirm effectiveness of the water chemistry program.

RAI 3.1-2 asked the applicant to explain why confirmation of effectiveness of the BWR Water Chemistry Program is not needed with regard to managing the aging effect of loss of material in carbon steel MS flow elements/restrictors exposed to treated water.

RAI 3.1-3 asked the applicant to explain why generic Note A or Note C, indicating that the AMP used is consistent with the AMP recommended in the GALL Report, was used for multiple AMR result lines in Table 3.1.2-3 where the applicant proposed using the BWR Water Chemistry Program in combination with the Small Bore Class 1 Piping Inspection, but the GALL Report recommends GALL AMP XI.M2, "Water Chemistry," in combination with GALL AMP XI.M32, "One-Time Inspection," for managing loss of material.

The applicant responded to RAI B.2.31-1 in a letter dated July 25, 2008, and to RAIs 3.1-1, 3.1-2, and 3.1-3 in a letter dated August 15, 2008. In those responses, the applicant revised all of the AMR results that referred to LRA Table 3.1.1, item 3.1.1-11, where the aging effect was managed either by the BWR Water Chemistry Program, alone, or by the BWR Water Chemistry Program in combination with the Small Bore Class 1 Piping Inspection. In the revised AMR results, the applicant proposes to manage loss of material for carbon steel components exposed to treated water with a

combination of the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection. The staff finds that use of the BWR Water Chemistry Program and the CPEI is consistent with recommendations in the GALL Report, and issues raised in RAIs B.2.31-1, 3.1-1, 3.1-2, and 3.1-3 were resolved by the applicant's changes to the LRA made in response to these RAIs.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the applicant's BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to general, pitting, and crevice corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the applicant's CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The applicant's CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to general, pitting, and crevice corrosion, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection for loss of material due to general, pitting, and crevice corrosion, the staff finds the applicant's LRA changes and the applicant's use of the BWR Water Chemistry Program and the CPEI for managing loss of material due to general, pitting, and crevice corrosion in steel components exposed to treated water in the reactor vessel top head enclosure and in the reactor coolant system pressure boundary to be acceptable.

For some components referring to LRA Table 3.1.1, item 3.1.1-11, the applicant credited the ISI Program in lieu of a one-time inspection program to confirm that the BWR Water Chemistry Program is effective in preventing loss of material due to corrosion. The components where the ISI Program is credited are carbon steel or unclad low alloy steel upper head components (dome, closure flange, and nozzles), and certain reactor coolant pressure boundary piping and fittings, and valve bodies greater than 4 inches nominal pipe size. For all of these components, the applicant's ISI Program requires volumetric and visual examinations. The staff reviewed the applicant's ISI Program, and the staff's evaluation of that program is documented in SER Section 3.0.3.2.1. The staff found that the ISI Program is capable of detecting loss of material for components of the reactor coolant pressure boundary, including piping, valves, and the reactor pressure vessel. On the basis that the ISI Program's examination methodology is capable of detecting loss of material in the subject components, the staff finds it acceptable for the applicant to credit the ISI Program in lieu of a one-time inspection program for confirming that the BWR Water Chemistry Program is effective in preventing loss of material due to corrosion in those components.

The staff confirmed that SRP-LR Table 3.1-1, Item 12, is only applicable to PWR plants and is not applicable to SSES, because SSES is a BWR .

(2) LRA Section 3.1.2.2.2.2 addresses loss of material due to general, pitting, and crevice corrosion in isolation condenser components. The applicant stated that this aging effect is not applicable because SSES design does not include an isolation condenser.

SRP-LR Section 3.1.2.2.2 states that loss of material due to pitting and crevice corrosion may occur in stainless steel BWR isolation condenser components exposed to reactor coolant. Loss of material due to general, pitting, and crevice corrosion may occur

in steel BWR isolation condenser components. The existing program controls reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The staff verified in the UFSAR, Rev. 63 that SSES is a BWR that does not have an isolation condenser.

On the basis of its review, the staff concluded that because SSES is a BWR without an isolation condenser, SRP-LR Section 3.1.2.2.2.2 is not applicable to SSES.

(3) LRA Section 3.1.2.2.2 addresses loss of material due to general, pitting, and crevice corrosion in flanges, nozzles, penetrations, pressure housings, safe ends, and vessel shells, heads, and welds. The applicant stated that the BWR Water Chemistry Program is supplemented by the ISI Program for managing loss of material due to crevice and pitting corrosion for the steel RV upper head closure flange and shell closure flange with stainless steel cladding exposed to reactor coolant. A one-time inspection is not credited. The BWR Water Chemistry Program alone is credited for managing loss of material due to crevice and pitting corrosion of the steel RV shell rings, ID attachments and welds, bottom head, nozzles, safe ends, and CRD stub tubes and housings with stainless steel cladding exposed to reactor coolant. A one-time inspection is not credited. The BWR Water Chemistry Program in association with the Small Bore Class 1 Piping Inspection or the ISI Program manages loss of material due to pitting and crevice corrosion for stainless steel components of the reactor coolant system (RCS) pressure boundary exposed to reactor coolant. The Small Bore Class 1 Piping Inspection is a one-time inspection.

SRP-LR Section 3.1.2.2.2 states that loss of material due to pitting and crevice corrosion may occur in stainless steel, nickel alloy, and steel with stainless steel or nickel alloy cladding flanges, nozzles, penetrations, pressure housings, safe ends, and vessel shells, heads, and welds exposed to reactor coolant. The existing program controls reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The staff reviewed all AMR results lines referring to LRA Table 3.1.1, items 3.1.1-14 or 3.1.1-15, and to LRA Section 3.1.2.2.2.3. The staff noted that the AMR results can be divided into four categories based upon the AMPs proposed by the applicant: 1) AMR results where loss of material is managed by the BWR Water Chemistry Program,

alone; 2) AMR results where loss of material is managed by a combination of the BWR Water Chemistry Program and the Small Bore Class 1 Piping Inspection; 3) AMR results where loss of material is managed by a combination of the BWR Water Chemistry Program and the ASME Code Section XI Inservice Inspection (IWB, IWC, and IWD) program; and 4) AMR results where loss of material is managed by a combination of the BWR Water Chemistry Program and the BWR Vessel Internals Program. For AMR results in the first, third and fourth category, the applicant cited generic Note E indicating that the material, environment and aging effect are consistent with the GALL Report but a different aging management program is credited. For AMR results in the second category, BWR Water Chemistry Program and Small Bore Class 1 Piping Inspection, the applicant cited generic Note A indicating that the component, material, environment, aging effect, and AMP are all consistent with the GALL Report.

As a result of its review of the applicant AMP B.2.31, Small Bore Class 1 Piping Inspection, and the applicant's AMR results, the staff issued requests for additional information in letters dated June 23, 2008, and July 15, 2008:

- RAI B.2.31-1 asked the applicant to reconcile inconsistencies related to the applicant's claim that the Small Bore Class 1 Piping Inspection is consistent with GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small Bore Piping."

- RAI 3.1-1 asked the applicant to justify how the BWR Water Chemistry Program, alone, would provide adequate aging management for loss of material for those AMR results where no inspection was specified to confirm effectiveness of the water chemistry program.

The applicant responded to RAI B.2.31-1 in a letter dated July 25, 2008, and to RAI 3.1-1 in a letter dated August 15, 2008. In those responses, the applicant revised all of the AMR results that referred to LRA Table 3.1.1, items 3.1.1-14 or 3.1.1-15, where the aging effect was managed either by the BWR Water Chemistry Program or by the BWR Water Chemistry Program in combination with the Small Bore Class 1 Piping Inspection. In the revised AMR results, the applicant proposes to manage loss of material for stainless steel, nickel alloy, and steel with stainless steel or nickel alloy clad components exposed to treated water with a combination of the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection. The staff finds that use of the BWR Water Chemistry Program and the CPEI is consistent with recommendations in the GALL Report.

The staff also noted that the applicant had aligned its AMR on loss of material in the external surfaces of the reactor recirculation pump thermal barrier to GALL AMR IV.C1-14. In this AMR, the staff noted that the applicant credited both its Water Chemistry Program and Inservice Inspection Program to manage loss of material in the external surfaces that are exposed to the treated water environment of the reactor coolant. Consistent with other AMRs on loss of material due to pitting and crevice corrosion on AMSE Code Class 1 components, the staff determined that the crediting of the Water Chemistry Program for mitigation of pitting and crevice corrosion was acceptable because the AMP is designed to prevent or mitigate loss or material that may be induced by corrosive aging mechanisms (e.g., such as pitting or crevice corrosion). However, the staff was concerned that it might not be appropriate to credit the Inservice Inspection Program for aging management of loss of material in the external thermal

barrier surfaces because they may be located in areas that are inaccessible for examination. In RAI 3.1.2.2.2.3-3 dated July 23, 2008, the staff asked the applicant to clarify which type of ISI examinations and requirements will be used to monitor for and detect loss of material in the external surfaces of the recirculation pump thermal barriers and whether the external surfaces of the reactor recirculation pump thermal barriers are accessible for ISI examination method that is credited for aging management.

The applicant responded to RAI 3.1.2.2.2.3-3 by letter dated August 27, 2008. In its response, the applicant stated that the external surfaces of the reactor recirculation pump thermal barriers are inaccessible for examination when the pump is assembled. The applicant further stated that since the pumps are not disassembled on any periodic or planned frequency, the ISI Program is not an appropriate aging management program for loss of material.

The applicant further stated that an appropriate aging management approach is to credit the CPEI to supplement the BWR Water Chemistry Program. The applicant also stated that although the external surfaces of the reactor recirculation pump thermal barrier are inaccessible for inspection, the CPEI will inspect other components of like material exposed to treated water to confirm that loss of material has been effectively mitigated or to detect any degradation that is occurring. The inspection of an alternative location is acceptable because the alternative location has a material and an environment equivalent to the reactor recirculation pump thermal barriers.

The applicant revised the line entry in Table 3.1.2-3 to credit the CPEI in place of the ISI Program. The applicant also indicated that this line item is consistent with GALL Item IV.C1-14, which recommends water chemistry program augmented by a one-time inspection program to manage loss of material for stainless steel components exposed to treated water.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the applicant's BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to pitting and crevice corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the applicant's CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The applicant's CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to pitting and crevice corrosion, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection for loss of material due to pitting, and crevice corrosion, the staff finds the applicant's LRA changes and the applicant's use of the BWR Water Chemistry Program and the CPEI for managing loss of material due to pitting, and crevice corrosion for stainless steel, nickel alloy, and steel with stainless steel or nickel alloy clad components exposed to treated water in the reactor pressure vessel and in the reactor coolant system pressure boundary to be acceptable.

For some components referring to LRA Table 3.1.1, items 3.1.1-14 and 3.1.1-15, the applicant credited the ISI Program in lieu of a one-time inspection program to confirm that the BWR Water Chemistry Program is effective in preventing loss of material due to pitting or crevice corrosion. The components where the ISI Program is credited are

stainless steel clad reactor vessel and upper head closure flanges, stainless steel pump casings and covers, piping and valve bodies greater than 4 inch nominal pipe size and tubing, and steam line flow restrictors. For all of these components, the applicant's ISI Program requires volumetric and visual examinations (except tubing where only visual examination is required). The staff reviewed the applicant's ISI Program, and the staff's evaluation of that program is documented in SER Section 3.0.3.2.1. The staff found that the ISI Program is capable of detecting loss of material for components of the reactor coolant pressure boundary, including piping, tubing, pump casings, valves, flow restrictors, and the reactor pressure vessel. On the basis that the ISI Program's examination methodology is capable of detecting loss of material in the subject components, the staff finds it acceptable for the applicant to credit the ISI Program in lieu of a one-time inspection program for confirming that the BWR Water Chemistry Program is effective in preventing loss of material due to corrosion in those components.

For vessel internal components referring to LRA Table 3.1.1, item 3.3.1-14, the applicant credited the BWR Vessel Internals Program in lieu of a one-time inspection program to confirm that the BWR Water Chemistry Program is effective in preventing loss of material due to pitting and crevice corrosion. The staff reviewed the applicant's BWR Vessel Internals Program, and the staff's evaluation is documented in SER Section 3.0.3.2.4. The staff found that the BWR Vessel Internals Program is capable of detecting loss of material due to pitting and crevice corrosion for stainless steel or nickel alloy components that are within its scope. On the basis that the BWR Vessel Internals Program is capable of detecting loss of material in the subject components, the staff finds it acceptable for the applicant to credit the BWR Vessel Internals Program in lieu of a one-time inspection program for confirming that the BWR Water Chemistry Program is effective in preventing loss of material due to pitting and crevice corrosion in stainless steel or nickel alloy reactor vessel internals.

(4) LRA Section 3.1.2.2.2 addresses loss of material due to general, pitting, and crevice corrosion in PWR steam generator upper and lower shell and transition cone. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.2 states that loss of material due to general, pitting, and crevice corrosion may occur in the steel PWR steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam.

The staff confirmed that SRP-LR Table 3.1-1, Item 16, is only applicable to PWR plants.

On the basis of its review, the staff concluded that because SSES is a BWR, SRP-LR Section 3.1.2.2.2.4 is not applicable to SSES.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2 criteria. For those line items that apply to LRA Section 3.1.2.2.2, the staff determines that the LRA, as amended in response to associated RAIs, is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

The staff reviewed LRA Section 3.1.2.2.3 against the following criteria in SRP-LR Section 3.1.2.2.3:

(1) LRA Section 3.1.2.2.3 states that neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.2 documents the staff's review of the applicant's evaluation of this TLAA.

(2) LRA Section 3.1.2.2.3 addresses loss of fracture toughness due to neutron irradiation embrittlement in RV beltline shell, nozzle, and welds. The applicant stated that reduction in fracture toughness due to radiation embrittlement could occur for RV beltline region materials exposed to reactor coolant and neutron flux. A RV materials surveillance program monitors radiation embrittlement of the steel RV beltline materials with stainless steel cladding. The Reactor Vessel Surveillance Program, and the results of its evaluation for license renewal, are presented in Appendix B of the LRA.

SRP-LR Section 3.1.2.2.3 states that loss of fracture toughness due to neutron irradiation embrittlement may occur in BWR and PWR RV beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. A RV materials surveillance program monitors neutron irradiation embrittlement of the RV. Reactor vessel surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further staff evaluation is required for license renewal. Specific recommendations for an acceptable AMP are provided in GALL Report Chapter XI, Section M31.

LRA Section 3.1.2.2.3.1 provides the applicant's discussion on management of neutron irradiation embrittlement TLAA. The applicant states that, "Certain aspects of neutron irradiation embrittlement are time-limited aging analyses (TLAAs) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff's acceptance of this TLAA is documented separately in Section 4.2 of this SER.

LRA Section 3.1.2.2.3.2 provides the applicant's discussion on management of neutron irradiation embrittlement using Reactor Vessel Surveillance Program. The applicant has implemented the BWRVIP Integrated Surveillance Program (ISP) based on the BWRVIP-78 report and the BWRVIP-86-A report. The NRC approved the two BWRVIP reports in an SE dated February 1, 2002. BWRVIP-116 incorporates the technical criteria specified in BWRVIP-78 and BWRVIP-86 and extends the ISP to cover the BWR fleet through the period of extended operation. The applicant committed to address any NRC imposed requirements of BWRVIP-116 (Commitment No. 18), when approved. The staff's acceptance of Reactor Vessel Surveillance Program with Commitment No. 18 is documented in Section 3.0.3.2.12 of this SER.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.3 criteria. For those line items that apply to LRA Section 3.1.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.4 against the following criteria in SRP-LR Section 3.1.2.2.4:

(1) LRA Section 3.1.2.2.4 addresses cracking due to SCC and IGSCC in BWR top head enclosure vessel flange leak detection lines. The applicant stated that the RV flange leak detection line at SSES is a Class 1 line that is normally dry. The stainless steel line is evaluated for a treated water environment and is therefore susceptible to cracking due to SCC. This aging effect is managed with a combination of the BWR Water Chemistry Program and the Small Bore Class 1 Piping Inspection.

SRP-LR Section 3.1.2.2.4 states that cracking due to SCC and IGSCC may occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the applicant's BWR Water Chemistry Program provides mitigation for the aging effect of cracking caused by SSC or IGSCC in stainless steel piping exposed to treated water. The staff reviewed the applicant's Small Bore Class 1 Piping Inspection program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.18, found that the applicant's Small Bore Class 1 Piping Inspection program provides for a one-time examination of ASME Code Class 1 small bore piping using volumetric examination techniques that are capable of detecting piping cracks caused by SCC or IGSCC. Based on the staff's determination that the BWR Water Chemistry Program provides mitigation for the aging effect of cracking due to SCC or IGSCC, and the Small Bore Class 1 Piping Inspection program provides detection of potential cracking due to SCC or IGSCC, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking in the stainless steel flange leak detection lines to be acceptable.

(2) LRA Section 3.1.2.2.4 addresses cracking due to SCC and IGSCC in isolation condenser components. The applicant stated that this aging effect is not applicable because SSES design does not include an isolation condenser.

SRP-LR Section 3.1.2.2.4 states that cracking due to SCC and IGSCC may occur in stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program controls reactor water chemistry to mitigate SCC and relies on ASME Code Section XI ISI; however, the existing program should be augmented to detect cracking due to SCC and IGSCC. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water and eddy current testing of tubes to ensure that component intended functions will be maintained during the period of extended operation.

SRP-LR Section 3.1.2.2.4.2 invokes the AMR Item 20 in Table 1 of the GALL Report, Volume 1 and AMR Item IV.C1-4 of the GALL Report, Volume 2 on management of cracking due to SCC and IGSCC in stainless steel BWR isolation condenser components that are exposed to the treated water environment of the reactor coolant.

The staff reviewed the UFSAR for SSES. The staff verified that the units do not include isolation condensers. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.4.2 and in GALL AMR IV.C1-4 are not applicable to the SSES LRA, because the SSES plant designs does not include isolation condenser systems.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.4 criteria. For those line items that apply to LRA Section 3.1.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.5 Crack Growth Due to Cyclic Loading

LRA Section 3.1.2.2.5 addresses crack growth due to cyclic loading. The applicant stated that this aging effect is not applicable because SSES is a BWR.

The staff reviewed LRA Section 3.1.2.2.5 against the criteria in SRP-LR Section 3.1.2.2.5 which states that crack growth due to cyclic loading can occur in the reactor vessel shell forgings clad with stainless steel using a high-heat-input welding process.

The staff confirmed in SRP-LR Table 3.1-1, Item 21, is only applicable to PWR plants.

On the basis of its review, the staff concluded that because SSES is a BWR, SRP-LR Section 3.1.2.2.5 is not applicable to SSES.

3.1.2.2.6 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and Void Swelling

The staff reviewed LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6.

LRA Section 3.1.2.2.6 addresses loss of fracture toughness due to neutron irradiation embrittlement and void swelling. The applicant stated that this aging effect is not applicable because SSES is a BWR.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.6 criteria is not applicable.

3.1.2.2.7 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.7 against the following criteria in SRP-LR Section 3.1.2.2.7:

(1) LRA Section 3.1.2.2.7 addresses cracking due to SCC in PWR stainless steel RV flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.7 states that cracking due to SCC may occur in the PWR stainless steel RV flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant.

The staff reviewed the UFSAR for SSES. The staff determined that the UFSAR Chapter 1 indicates that the SSES reactors are General Electrical (GE) Model 4 BWRs with Mark II containment structures. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.7.1 are not applicable to the SSES LRA, because the SSES plants are not PWR designed reactors.

The staff confirmed in SRP-LR Table 3.1-1, Item 23, is only applicable to PWR plants. Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.7.1 does not apply to SSES.

(2) LRA Section 3.1.2.2.7 addresses cracking due to SCC in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping, piping components, and piping elements exposed to reactor coolant. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.7 states that cracking due to SCC may occur in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping, piping components, and piping elements exposed to reactor coolant.

The staff reviewed the UFSAR for SSES. The staff determined that the UFSAR Chapter 1 indicates that the SSES reactors are General Electrical (GE) Model 4 BWRs with Mark II containment structures. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.7.2 are not applicable to the SSES LRA, because the SSES plants are not PWR designed reactors.

The staff confirmed in SRP-LR Table 3.1-1, Item 24, is only applicable to PWR plants. Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.7.2 does not apply to SSES.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.7 criteria is not applicable.

3.1.2.2.8 Cracking Due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.8 against the following criteria in SRP-LR Section 3.1.2.2.8:

(1) LRA Section 3.1.2.2.8 addresses cracking due to cyclic loading in stainless steel BWR jet pump sensing lines. The applicant stated that for SSES, the jet pump instrumentation lines inside the vessel are not subject to AMR, as they do not perform an intended function. The lines outside of the vessel are part of the RCS pressure boundary and are subject to AMR for a reactor coolant environment. Cracking of the stainless steel lines external to the vessel is managed with a combination of the BWR Water Chemistry Program and the Small Bore Class 1 Piping Inspection.

SRP-LR Section 3.1.2.2.8 states that cracking due to cyclic loading may occur in the stainless steel BWR jet pump sensing lines. The GALL Report recommends that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed.

The staff reviewed the applicant's statement that the jet pump sensing lines inside the reactor vessel are not subject to AMR. The staff noted that the jet pump sensing lines inside the vessel are not part of the reactor coolant pressure boundary and that the function of the jet pump sensing lines is to provide indication of jet pump flow, which is not a license renewal intended function. Since the jet pump sensing lines inside the reactor vessel are not part of the reactor coolant pressure boundary and are not required to support a license renewal intended function, the staff finds the applicant's statement that jet pump sensing lines inside the reactor vessel are not subject to AMR to be acceptable.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the applicant's BWR Water Chemistry Program provides mitigation for the aging effect of cracking caused by SSC in stainless steel piping exposed to treated water. The staff reviewed the applicant's Small Bore Class 1 Piping Inspection program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.18, found that the applicant's Small Bore Class 1 Piping Inspection program provides for a one-time examination of ASME Code Class 1 small bore piping using volumetric examination techniques that are capable of detecting piping cracks caused by SCC, IGSCC or cyclic loading. Based on the staff's determination that the BWR Water Chemistry Program provides mitigation for potential cracking and the Small Bore Class 1 Piping Inspection program provides detection of cracks due to SCC, IGSCC or cyclic loading, should they occur, the staff finds the applicant's proposed AMPs for managing the potential aging effect of cracking in the stainless steel jet pump sensing lines outside the reactor vessel to be acceptable.

(2) LRA Section 3.1.2.2.8 addresses cracking due to cyclic loading in isolation condenser components. The applicant stated that this aging effect is not applicable because SSES design does not include an isolation condenser.

SRP-LR Section 3.1.2.2.8 states that cracking due to cyclic loading may occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program relies on ASME Code Section XI ISI; however, the existing program should be augmented to detect cracking due to cyclic loading. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water and eddy current testing of tubes to ensure that component intended functions will be maintained during the period of extended operation.

SRP-LR Section 3.1.2.2.8.2 invokes the AMR Item 26 in Table 1 of the GALL Report, Volume 1 and AMR Item IV.C1-5 of the GALL Report, Volume 2 on management of cracking due to cyclical loading in steel and stainless steel BWR isolation condenser components that are exposed to the treated water environment of the reactor coolant.

The staff reviewed the UFSAR for SSES. The staff verified that the units do not include isolation condensers. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.8.2 and in GALL AMR IV.C1-5 are not

applicable to the SSES LRA because the SSES plant designs do not include isolation condenser systems.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.8 criteria. For those line items that apply to LRA Section 3.1.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

The staff reviewed LRA Section 3.1.2.2.9 against the criteria in SRP-LR Section 3.1.2.2.9.

LRA Section 3.1.2.2.9 addresses loss of preload due to stress relaxation. The applicant stated that this aging effect is not applicable because SSES is a BWR.

The staff reviewed the UFSAR for SSES. The staff determined that the UFSAR Chapter 1 indicates that the SSES reactors are General Electrical (GE) Model 4 BWRs with Mark II containment structures. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.9 are not applicable to the SSES LRA because the SSES plants are not PWR designed reactors.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.9 criteria is not applicable.

3.1.2.2.10 Loss of Material Due to Erosion

The staff reviewed LRA Section 3.1.2.2.10 against the criteria in SRP-LR Section 3.1.2.2.10.

LRA Section 3.1.2.2.10 addresses loss of material due to erosion in steam generators. The applicant stated that this aging effect is not applicable because SSES is a BWR.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.10 does not apply to SSES.

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.1.2.2.10 criteria is not applicable.

3.1.2.2.11 Cracking Due to Flow-Induced Vibration

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

LRA Section 3.1.2.2.11 addresses cracking due to flow-induced vibration. The applicant stated that cracking due to flow-induced vibration for SSES stainless steel steam dryers exposed to reactor coolant is managed by a combination of the BWR Vessel Internals Program and the BWR Water Chemistry Program.

SRP-LR Section 3.1.2.2.11 states that cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant. The GALL Report

recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

SRP-LR Section 3.1.2.2.11 invokes the AMR Item 29 in Table 1 of the GALL Report, Volume 1 and AMR IV.B1-16 in the GALL Report, Volume 2 on management of cracking due to flow-induced vibration stainless steel BWR steam dryers.

The staff reviewed the information in LRA Section 3.1.2.2.11 and in LRA Table 3.1.2-2 against the staff's recommended AMR guidance in SRP-LR Section 3.1.2.2.11 and in GALL AMR IV.B1-16. The staff verified that in LRA Table 3.1.2-2, the applicant has included an AMR that aligns to GALL AMR IV.B1-16, and that in the AMR, the applicant credits a combination Water Chemistry Program and BWR Vessel Internals Program to manage cracking of the steam dryers that is induced by flow-induced vibration.

The staff noted that the aging mechanism of concern is a high cycle fatigue mechanism and that this mechanism is not dependent on the concentrations of chemical impurities that could lead to corrosive type of cracking, such stress corrosion cracking (SCC, including intergranular stress corrosion cracking [IGSCC], primary water stress corrosion cracking [PWSCC]) and intergranular attack (IGA).

Thus, the staff noted that the applicant's crediting of the Water Chemistry Program did not create a valid basis for aging management of cracking due to flow-induced vibrations because flow-induced vibrations are a high-cycle fatigue phenomenon and are not dependent on the control of water chemistry impurity concentrations.

The staff also noted that the applicant credited its BWR Vessel Internals Program (LRA AMP B.2.9) for aging management and that the applicant's program is identified as a program that is consistent with the recommended program elements of GALL AMP XI.M9, "BWR Vessel Internals," with an enhancement to perform augmented inspections of the SSES top guide grid beam and beam-to-beam crevice slots. The staff reviewed GALL AMP XI.M9 and confirmed that, although the BWRVIP has submitted a number of BWRVIP topical reports on evaluation of flow-induced vibrations in BWR steam dryers and on inspection of BWR steam dyers and management of cracking that may result in BWR steam dryers as a result of flow-induced vibrations, none of the BWRVIP reports on BWR steam dryer flow induced vibrations and cracking have been approved to date or endorsed in GALL AMP XI.M9, "BWR Vessel Internals." Thus the staff was of the opinion that the applicant's BWR Vessel Internals Program, in its current form, did not provide a valid basis for managing cracking due to flow-induced vibrations in the steam dryers because the applicant's program does not currently include any enhancements and commitments to: (1) of perform flow-induced vibration high cycle fatigue flaw growth calculations of the steam dryers, (2) establish the flaw evaluation and corrective action recommendations on postulated steam dryer cracking, and (3) establish the augmented inspection recommendations for the steam dryers (including the inspection methods and frequency for the examinations to be performed).

In RAI 3.1.2.2.11-1 by letter dated July 23, 2008, the staff asked the applicant to justify its selection of the Water Chemistry Program and the BWR Vessel Internals Program for aging management of cracking due to flow-induced vibrations of the steam dryers.

In its letter dated August 27, 2008, in response to RAI 3.1.2.2.11-1, the applicant stated that the BWR Water Chemistry Program does not manage cracking due to flow-induced vibration. The applicant revised the LRA to delete the BWR Water Chemistry Program from the line entry for

cracking of the steam dryers in LRA Table 3.1.2-2. The applicant stated the following for crediting the BWR Vessel Internals Program to manage cracking of the steam dryers:

> The technical basis for crediting the BWR Vessel Internals Program (BWRVIP) for management of cracking due to flow-induced vibration in the steam dryers is that the BWRVIP incorporates the best industry guidance that is currently available from BWRVIP reports BWRVIP- 139, BWRVIP- 181, and BWRVIP- 182.
>
> PPL will follow Section 6 of BWRVIP-139 when evaluating cracking in the steam dryer. PPL has instrumented the newly designed steam dryer in Unit 1 to obtain data on the actual stresses in the dryer during current licensed power at extended power uprate (EPU) conditions. Based on the measured stresses, PPL will perform a flow-induced vibrational analysis. If any fatigue flaws are identified during the BWRVIP-required inspections, PPL can accurately calculate flaw growth and establish re-inspection intervals.
>
> Currently, there is no regulatory basis for management of cracking due to flow-induced vibration in the steam dryers. GALL line item IV.B 1-16 recommends a plant-specific program, which, in effect, acknowledges that there is no generically accepted or approved program for management of flow-induced vibration of the steam dryers. However, since the BWRVIP includes provisions to incorporate all approved BWRVIP documents, or to file notice of exception, the program requires its own modification if the NRC requires changes to BWRVIP- 139, BWRVIP- 181, and BWRVIP- 182 prior to their approval. Consequently, there is no need to enhance AMP B.2.9, the BWR Vessel Internals Program, at this time.

The staff reviewed the applicant response and noted that the applicant proposes to use BWRVIP-139, Steam Dryer Inspection and Flaw Evaluation Guidelines, to manage the aging effect of cracking in the steam dryers. The staff issued its safety evaluation on BWRVIP-139 in a letter to the BWRVIP dated July 30, 2008. For re-inspection, the staff stated that the guidelines below should be followed:

- Each BWR licensee will determine the appropriate re-inspection approach according to GE SIL-644 or BWRVIP-139 in consideration of the steam dryer performance at its plant.
- License conditions associated with steam dryer monitoring programs in power uprate license amendments take precedence over the steam dryer re-inspection provisions in GE SIL-644 or BWRVIP-139.
- The licensee will justify any adjustments to its steam dryer re-inspection program where commitments exist to implement the re-inspection provisions in GE SIL-644 to support a power uprate license amendment or other activities.
- The licensee is expected to inform the NRC staff of significant changes to its steam dryer re-inspection program where the staff relied on the program in a regulatory decision.

The staff finds the deletion of the Water Chemistry Program to be acceptable because flow-induced vibrations are a high-cycle fatigue phenomenon and are not dependent on the control of water chemistry impurity concentrations.

The staff noted that the applicant has instrumented the dryer to obtain data on actual stresses during extended power uprate conditions. Based on this data, the applicant plans to perform a

flow-induced vibrational analysis. The staff concludes that the applicant is implementing the guidelines of BWRVIP-139 as accepted by the staff in its SE and on the basis that the applicant's BWR Vessel Internals Program includes provisions to incorporate all approved BWRVIP documents, and the BWR Vessel Internals Program has incorporated the guidelines of BWRVIP-139, the staff finds the applicant response acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.11 criteria. For those line items that apply to LRA Section 3.1.2.2.11, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.12 Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.12 against the criteria in SRP-LR Section 3.1.2.2.12.

LRA Section 3.1.2.2.12 addresses cracking due to SCC and IASCC. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.12 states that cracking due to SCC and IASCC may occur in PWR stainless steel reactor internals exposed to reactor coolant.

The staff confirmed in SRP-LR Table 3.1-1, Item 20, is only applicable to PWR plants.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.12 does not apply to SSES.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.12 criteria is not applicable.

3.1.2.2.13 Cracking Due to Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.13 against the criteria in SRP-LR Section 3.1.2.2.13.

LRA Section 3.1.2.2.13 addresses cracking due to primary water SCC (PWSCC). The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.13 states that cracking due to primary water SCC (PWSCC) may occur in PWR components made of nickel alloy and steel with nickel alloy cladding, including RCPB components and penetrations inside the reactor coolant system such as pressurizer heater sheathes and sleeves, nozzles, and other internal components.

The staff confirmed in SRP-LR Table 3.1-1, Item 31, is only applicable to PWR plants.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.13 does not apply to SSES.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.13 criteria is not applicable.

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.14 against the criteria in SRP-LR Section 3.1.2.2.14.

LRA Section 3.1.2.2.14 addresses wall thinning due to FAC in steam generators. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.14 states that wall thinning due to FAC may occur in steel FW inlet rings and supports.

The staff confirmed in SRP-LR Table 3.1-1, Item 32, is only applicable to PWR plants.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.14 does not apply to SSES.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.14 criteria is not applicable.

3.1.2.2.15 Changes in Dimensions Due to Void Swelling

The staff reviewed LRA Section 3.1.2.2.15 against the criteria in SRP-LR Section 3.1.2.2.15.

LRA Section 3.1.2.2.15 addresses changes in dimension due to void swelling. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.15 states that changes in dimensions due to void swelling may occur in stainless steel and nickel alloy PWR internal components exposed to reactor coolant.

The staff confirmed in SRP-LR Table 3.1-1, Item 33, is only applicable to PWR plants.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.15 does not apply to SSES.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.15 criteria is not applicable.

3.1.2.2.16 Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.16 against the following criteria in SRP-LR Section 3.1.2.2.16:

(1) LRA Section 3.1.2.2.16 addresses cracking due to SCC and primary water SCC on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.16 states that cracking due to SCC may occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel. Cracking due to PWSCC

may occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with nickel alloy.

The staff reviewed the UFSAR for SSES. The staff determined that the UFSAR Chapter 1 indicates that the SSES reactors are General Electrical (GE) Model 4 BWRs with Mark II containment structures. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.16.1 are not applicable to the SSES LRA because the SSES plants are not PWR designed reactors.

The staff confirmed in SRP-LR Table 3.1-1, Item 34 and Item 35, is only applicable to PWR plants. Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.16.1 does not apply to SSES.

(2) LRA Section 3.1.2.2.16 addresses cracking due to SCC and primary water SCC on stainless steel pressurizer spray heads. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.16 states that cracking due to SCC may occur on stainless steel pressurizer spray heads. Cracking due to PWSCC may occur on nickel alloy pressurizer spray heads.

The staff reviewed the UFSAR for SSES. The staff determined that the UFSAR Chapter 1 indicates that the SSES reactors are General Electrical (GE) Model 4 BWRs with Mark II containment structures. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.16.2 are not applicable to the SSES LRA because the SSES plants are not PWR designed reactors.

The staff confirmed in SRP-LR Table 3.1-1, Item 36, is only applicable to PWR plants. Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.16.2 does not apply to SSES.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.16 criteria are not applicable.

3.1.2.2.17 Cracking Due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.17 against the criteria in SRP-LR Section 3.1.2.2.17.

LRA Section 3.1.2.2.17 addresses cracking due to SCC, primary water SCC, and irradiation-assisted SCC. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.1.2.2.17 states that cracking due to SCC, PWSCC, and IASCC may occur in PWR stainless steel and nickel alloy RV internals components.

The staff confirmed in SRP-LR Table 3.1-1, Item 37, is only applicable to PWR plants. Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.17 does not apply to SSES.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.17 criteria are not applicable.

3.1.2.2.18 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.1.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.1.2-1 through 3.1.2-3, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-3, the applicant indicated, via notes F through J, which the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.1.2.3.1 Aging Management Review Results - Reactor Pressure Vessel – LRA Table 3.1.2-1

The staff reviewed LRA Table 3.1.2-1, which summarizes the results of AMR evaluations for the reactor pressure vessel component groups.

LRA Table 3.1.2-1 summarizes the results of AMRs for the Reactor Pressure Vessel low alloy steel, nickel based alloy, and low alloy steel clad with stainless steel, exposed to indoor air (external) for the reactor vessel upper head closure flange, safe ends, nozzles, reactor vessel bottom head flanges, reactor vessel shell rings, reactor vessel closure flange, and reactor vessel upper head (dome). The applicant proposed no aging effect for this material/environment combination and stated that no AMR is required.

The applicant assigned Note G for this material/environment combination. Note G states, "Environment not in NUREG-1801 for this component and environment combination."

During the staff's review, the staff pointed out that the low alloy steel is at high temperature during operation preventing the accumulation of moisture and therefore, insignificant corrosion will occur during this time period. The staff also pointed out that the only time that corrosion could occur is during outages, and these would not be of sufficient duration to result in significant corrosion.

During the staff's review, the staff pointed out that Stainless steels and nickel alloys are highly resistant to corrosion in dry atmospheres in the absence of corrosive species (which would be reflective of indoor uncontrolled air), as cited in Metals Handbook, Volumes 3 (p. 65) and 13 (p.555) (Ninth Edition, American Society for Metals International, 1980 and 1987). Components are not subject to moisture in a dry air environment (and indoor uncontrolled air would have limited humidity and condensation). Therefore, stainless steel in an indoor, uncontrolled air environment exhibits no aging effect, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

The staff concludes that there are no aging effects requiring management for these components because of the dry environment for low alloy steel and no aging effect for the nickel alloys or stainless steel cladding and stainless steel components in the Reactor Vessel, Reactor Vessel Internals and Reactor Coolant System components within the scope of license renewal

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.1.2-1, the applicant proposed to manage cracking due to stress corrosion cracking (SCC) in stainless steel cladding for low alloy steel in an environment of treated water using the BWR Water Chemistry Program, alone. The applicant cited generic Note H for these AMR results, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The staff noted that the BWR Water Chemistry Program does not include an inspection activity to confirm effectiveness of the program to mitigate the aging effect and issued RAI 3.1-8 by letter dated July 15, 2008, asking the applicant why a confirmatory AMP, such as the Water Chemistry Effectiveness Inspection, is not needed for these components.

In a letter dated August 15, 2008, the applicant responded to RAI 3.1-8 by providing the following response:

> The LRA Table 3.1.2-1 is revised to credit the Chemistry Program Effectiveness Inspection in addition to the BWR Water Chemistry Program for AMR result lines addressing stainless steel cladding in treated water with an aging effect of "cracking – SCC (cladding)."

The staff reviewed the applicant's response and the associated LRA changes. The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of cracking caused by SSC in stainless steel clad components exposed to treated water. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes examination methods that are capable of detecting cracking due to SCC. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection for cracking due to SCC, the staff finds the applicant's LRA changes and the applicant's use of the

BWR Water Chemistry Program and the CPEI for managing cracking due to SCC in the cladding of stainless steel clad components exposed to treated water in the reactor pressure vessel to be acceptable.

In LRA Table 3.1.2-1, the applicant includes its plant-specific AMRs on management of cracking – flaw growth in steel (carbon steel or alloy steel) reactor vessel (RV) components that are unclad or have internal stainless steel or nickel alloy cladding under internal exposure to the treated water environment of the reactor coolant:

- RV upper heads, closure flanges, shells, and bottom heads
- RV recirculation inlet nozzles, recirculation outlet nozzles, core spray nozzles, jet pump instrumentation nozzles,
- RV main steam line nozzles and their safe ends,
- RV head spray and spare nozzles, RV head vent nozzles, and their flanges
- RV feedwater nozzle safe ends, and RV N11, N12, and N16 instrumentation nozzle safe ends

In these AMRs, the applicant identifies that cracking/flaw growth is an applicable aging effect requiring management (AERM) for the internal component surfaces that are exposed to the reactor coolant. In these AMRs, the applicant credits its Inservice Inspection Program with management of cracking/flaw growth in the components.

The staff determined that the applicant conservatively identified cracking/flaw growth as an applicable AERM for the internal component surfaces that are exposed to the treated water environment of the reactor coolant. The staff noted that the applicant's aging effect cracking/flaw growth corresponds to the phrase "crack initiation and growth" in the definition for cracking that is provided in GALL Table IX.E. Based on this determination, the staff finds that the applicant has conformed to the guidance for cracking in GALL Table IX.E.

The staff also determined that the applicant has credited AMP B.2.1, Inservice Inspection Program as the basis for managing cracking/flaw growth in the internal component surfaces that are exposed to the treated water environment of the reactor coolant. The staff verified for the RV components assessed in this section that the Inservice Inspection Program requires the applicant to perform volumetric examinations of these components in accordance with the applicable volumetric and surface examination requirements in the ASME Code Section XI Examination Categories B-A, B-D, or B-F, as invoked by 10 CFR 50.55a. The required volumetric examinations use techniques (such as ultrasonic testing or radiography) that are capable of detecting cracks or imperfections throughout the thickness of the components. Thus, the inspections required by these examination categories are sufficient to detect and monitor for crack initiation and growth that may be occurring in these RV components. On this basis, the staff finds that the applicant has provided an acceptable basis for crediting the Inservice Inspection Program for aging management of cracking/flaw growth in these components as a result of exposure to the treated water environment of the reactor coolant.

Based on this review, the staff also concludes the applicant has provided an acceptable basis that demonstrates that the volumetric examinations performed under the Inservice Inspection Program will be capable of detecting and monitoring for cracking/flaw growth in these RV components. The staff's evaluation of the ability of the Inservice Inspection Program to manage cracking in AMSE Code Class components is given in SER Section 3.0.3.2.1.

In LRA Table 3.1.2-1, the applicant includes its plant-specific AMR on management of cracking – flaw growth in the alloy steel reactor vessel stabilizer brackets that are exposed externally to an indoor air environment. In this AMR, the applicant identifies that cracking/flaw growth is an applicable AERM for the external component surfaces that are exposed to the indoor air environment. In this AMR, the applicant credits its Inservice Inspection Program with management of cracking/flaw growth in the external component surfaces.

The staff determined that the applicant conservatively identified cracking/flaw growth as an applicable AERM for the external RV stabilizer bracket surfaces that are exposed to indoor air. The staff noted that the applicant's aging effect cracking/flaw growth corresponds to the phrase "crack initiation and growth" in the definition for cracking that is provided in GALL Table IX.E. Based on this determination, the staff finds that the applicant has conformed to the guidance for cracking in GALL Table IX.E.

The staff also determined that the applicant has credited AMP B.2.1, Inservice Inspection Program as the basis for managing cracking/flaw growth in the RV stabilizer bracket surfaces that are exposed externally to indoor air. The staff verified that, for the RV stabilizer brackets assessed in this section, the Inservice Inspection Program requires that the applicant to perform surface examinations of these components in accordance with the applicable volumetric and surface examination requirements in the ASME Code Section XI Examination Category B-K, as invoked by 10 CFR 50.55a. The required volumetric examinations use techniques (penetrant testing [PT] or magnetic particle test [MT]) that are capable of detecting potential cracks that penetrate the external surfaces of the stabilizer bracket welds. Thus, the inspections required by this ASME Code Section XI examination category are sufficient to detect and monitor for crack initiation and growth that may be occurring in the externals surfaces of the RV stabilizer brackets. On this basis, the staff finds that the applicant has provided an acceptable basis for crediting the Inservice Inspection Program for aging management of cracking/flaw growth in these components as a result of exposure to indoor air.

Based on this review, the staff also concludes that the Inservice Inspection Program is acceptable for management of the applicable AERMs because the applicant has provided an acceptable basis that demonstrates that the surface examinations performed under the Inservice Inspection Program will be capable of detecting and monitoring for cracking/flaw growth in the external RV stabilizer bracket surfaces that are exposed to indoor air. The staff's evaluation of the ability of the Inservice Inspection Program to manage cracking in AMSE Code Class components is given in SER Section 3.0.3.2.1.

In LRA Table 3.1.2-1, the applicant includes its plant-specific AMR on management of cracking – flaw growth in the nickel alloy N9 CRD nozzle cap that is exposed internally to the treated water environment of the reactor coolant. In this AMR, the applicant identifies that cracking/flaw growth is an applicable AERM for the internal component surfaces that are exposed to the reactor coolant. In this AMR, the applicant credits its BWR CRD Return Line Program with management of cracking/flaw growth in the internal component surfaces.

The staff determined that the applicant conservatively identified cracking/flaw growth as an applicable AERM for the internal CRD return line nozzle cap surfaces that are exposed to the reactor coolant. The staff noted that the applicant's aging effect cracking/flaw growth corresponds to the phrase "crack initiation and growth" in the definition for cracking that is provided in GALL Table IX.E. Based on this determination, the staff finds that the applicant met the guidance in SRP-LR 3.1.3.3 for identifying the applicable aging effects for these nozzle cap

surfaces because the applicant has conformed to the guidance for cracking in GALL Table IX.E.

The staff also determined that the applicant has credited AMP B.2.6, BWR CRD Return Line Nozzle Program as the basis for managing cracking/flaw growth in the internal surfaces of the CRD return line nozzle caps and their associated cap-to-nozzle circumferential welds that are exposed to the reactor coolant. The staff verified that, for these nozzle caps, the applicant's BWR CRD Return Line Nozzle Program is a program that is designed to manage cracking in the CRD return lines nozzles and that the AMP is consistent with the staff's recommended program elements for CRD return line nozzles in GALL AMP XI.M6, "CRD Return Line Nozzle," with an exception to perform weld overlay methods for repairs of existing cracks in the nozzles. The staff also verified that the scope of the AMP includes potential capping of the nozzles and their associated cap-to-nozzle circumferential welds. The staff evaluates the ability of the BWR CRD Return Line Nozzle Program to manage cracking in these components in SER Section 3.0.3.2.2. The staff evaluation includes an evaluation on the ability of the BWR CRD Return Line Nozzle Program to manage cracking in the CRD return line nozzle cap cap-to-nozzle circumferential welds and the exception to use weld overlay methods for repairs of cracking in these welds. On this basis, the staff finds that the applicant has provided an acceptable basis for crediting the BWR CRD Return Line Nozzle Program for aging management of cracking/flaw growth in these components as a result of exposure to the reactor coolant.

In LRA Table 3.1.2-1 the applicant includes its plant-specific AMR items for managing cracking and loss of material in the carbon steel reactor pressure vessel support skirt ring girders and cracking in the high strength alloy steel reactor pressure vessel support skirt bolts that are exposed to a indoor air environment. In these AMRs, the applicant credits its Inservice Inspection Program – IWF for aging management of these aging effects. The staff noted that the applicant's Inservice Inspection Program – IWF is a condition monitoring program that is based on compliance with the requirements of 10 CFR 50.55a and the ASME Code Section XI, Subsection IWF for ASME Code Class components supports and that the applicant program is based on conformance with the staff's recommended program elements in GALL AMP XI.S3, "ASME Section XI, Subsection IWF." Based on this review, the staff finds that the applicant has provided an acceptable basis for crediting its Inservice Inspection Program –IWF to manage cracking and loss of material in the reactor pressure vessel support skirt ring girders and cracking of the reactor pressure vessel support skirt bolts because these components are ASME Code Class 1 component supports. The staff evaluates the ability of the Inservice Inspection Program - IWF to manage aging in ASME Code Class 1 components in SER Section 3.0.3.1.21

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.2 Aging Management Review Results - Reactor Vessel Internals – LRA Table 3.1.2-2

The staff reviewed LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the RV internals component groups.

In LRA Table 3.1.2-2, the applicant includes its plant-specific AMRs on management of reduction in fracture toughness for the following stainless steel (including CASS) reactor vessel

(RV) internal components that are exposed to the treated water environment of the reactor coolant and an integrated neutron flux:

- Core shroud (including upper, intermediate, and lower shroud shells and welds)
- Core plate (including plate, beams, rim hold-down bolts and nuts, alignment assembly bolts and nuts and alignment pins)
- Top guide components (including beams and rim, alignment pins, bolts, nuts, and hold down clamps)
- Orificed and peripheral fuel support pieces
- Control Rod Drive tubes
- Jet pump assemblies and their subcomponents
- Incore dry tubes from the source range and intermediate range monitors

In these AMRs, the applicant states that it credits its BWR Vessel Internals Program to manage reduction of fracture toughness in the components.

The staff noted that in Table IV.B1 of GALL Volume 2, the staff identifies that the following cast austenitic stainless steel (CASS) BWR RV internal components may be subject to reduction of fracture toughness as a result of thermal aging embrittlement and neutron irradiation embrittlement:

- Fuel supports and CRD drive assemblies – fuel orifice supports (GALL AMR IV.B1-9)
- Jet pump assembly castings (GALL AMR IV.B1-11)

The staff noted that the applicant's plant-specific AMRs for these RV internal components accounts for the fact that, even though the components were not fabricated from a stainless steel casting method (i.e. the stainless steel components are made by forged or wrought fabrication methods, and thus the components not subject to the phenomenon of thermal aging embrittlement), the components are located in areas of high neutron flux and that the components may be subject to reduction of fracture toughness as a result of exposure to a high integrated neutron flux. Thus, the staff finds that the applicant has taken a conservative approach relative to the information on management of fracture toughness in GALL Table IV.B1 for BWR RV internal components.

The staff also noted that the applicant's AMRs did identify reduction (loss) of fracture toughness as an applicable AERM for these RV internal components (as listed in the bullets above), implying that these RV internal components are exposed to a high integrated neutron flux. The staff finds that the applicant's identification that reduction of fracture toughness is an applicable AERM for these components to be acceptable because it is in conformance with the aging effect discussion for loss of fracture toughness in GALL Table IX.E and the neutron irradiation embrittlement aging mechanism discussion in GALL Table IX.F.

The staff noted, however, that the applicant had credited its BWR Vessel Internals Program to manage reduction in fracture toughness in these RV internal components. The staff verified that the applicant's BWR Vessel Internals Program is given in LRA Section B.2.9 and that the program is identified as an AMP that is consistent with the program elements in GALL AMP XI.M9, "BWR Vessel Internals, with an exception. The staff noted that this AMP credits the

augmented inspection and flaw evaluation criteria in NRC-approved BWRVIP topical reports as the basis for managing the aging effects that are applicable to BWR RV and RV internal components. The staff noted that reduction in fracture toughness is not an aging effect "per se" but instead refers to a change that may occur in the fracture toughness material property over time. In its review of the applicant's BWR Vessel Internals Program, the staff noted that the applicant credits the program with limited aging management of reduction of fracture toughness in RV internal components. However, the staff determined that some additional information would be needed to clarify how the recommended BWRVIP report guidelines within the scope of AMP B.2.9, BWR Vessel Internals Program, would accomplish adequate management of reduction of fracture toughness in these RV internal components. In RAI 3.1.2.3.2.1-1/B.2.9-4 by letter dated July 23, 2008, the staff asked the applicant to justify why the applicable BWRVIP inspection and flaw evaluation guidelines are considered to be capable of managing reduction of fracture toughness in these RV internals and to clarify the methodology or methodologies in these reports that are credited for management of this aging effect.

In its response to RAI 3.1.2.3.2.1-1/B.2.9-4 dated August 27, 2008, the applicant stated that "applicable BWRVIP inspection and flaw evaluation guidelines for RV internal components are considered to be capable of managing reduction of fracture toughnss (ROFT) because the inspections are designed to detect cracking, and, if cracking is detected, the inspection intervals will be adjusted based on crack growth rates that are determined by evaluations that include the effects of ROFT. The examination methods in the BWRVIP reports include ultrasonic examination and visual examination of the RV internal components, when accessible, for the detection of cracks. These same methods are credited for managing ROFT, since ROFT is managed as cracking is identified, evaluated, and monitored in components with fluence values exceeding the threshold for ROFT."

Because the BWRVIP guidelines provide examination methods and evaluation techniques to detect cracking, and inspection intervals are adjusted based on the results of the inspection, the staff finds that the guidelines will also manage ROFT, since fluence is one of the key factors affecting the crack growth rate, which increases as fluence increases the yield strength of the material (i.e., reduces fracture toughness). The staff reviewed the applicant's BWR Vessel Internals Program and its evaluation is documented in SER Section 3.0.3.2.4. On this basis, the staff finds the applicant response acceptable, and considers the issue closed.

On this basis, the staff finds that the applicant has provided an acceptable basis for crediting the BWR Vessel Internals Program for aging management of reduction of fracture toughness in these components as a result of exposure to treated water environment of the reactor coolant and an integrated neutron flux.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.3 Aging Management Review Results - Reactor Coolant System Pressure Boundary – LRA Table 3.1.2-3

The staff reviewed LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the reactor coolant system pressure boundary component groups.

In LRA Table 3.1.2-3, the applicant proposed to manage loss of material for steel material for driver mount, piping and fitting components exposed to an external environment of indoor air using the AMP B.2.32 "System Walkdown Program." In addition, the applicant also proposed to manage the loss of material for carbon steel valve bodies (≥ 4 and < 4 in.) components exposed to external environment of indoor air using the AMP B.2.32 "System Walkdown Program."

The AMR line item credits the AMP B.2.32 "System Walkdown Program" to manage loss of material for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in GALL Report for this component, environment and material combination. The staff's evaluation of the AMP B.2.32 "System Walkdown Program" is documented in SER Section 3.0.3.2.14. The staff determined that this program is a condition monitoring program that will detect the aging effect of loss of material for metals, including steel, by periodic surveillance activities and observations of components' external surfaces to detect aging degradation that are within the scope of license renewal. On the basis that the applicant will be performing periodic visual inspections of these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.1.2-3, the applicant includes its plant-specific AMR on management of loss of material in the internal reactor recirculation pump thermal barrier surfaces that are exposed to the treated, closed-cycle cooling water environment. In this AMR, the staff noted that the applicant credited both its Closed Cooling Water Program and Inservice Inspection Program to manage loss of material in the internal surfaces that are exposed to the treated water environment of the reactor coolant. The staff determined that the crediting of the Water Chemistry Program for mitigation of pitting and crevice corrosion was acceptable because the AMP is designed to prevent or mitigate loss or material that may be induced by corrosive aging mechanisms (e.g., such as pitting or crevice corrosion). However, the staff was concerned that it might not be appropriate to credit the Inservice Inspection Program for aging management of loss of material in the internal thermal barrier surfaces because they may be located in areas that are inaccessible for examination. In RAI 3.1.2.3.3.2-1 dated July 23, 2008, the staff asked the applicant to clarify whether the internal surfaces of the reactor recirculation pump thermal barriers are accessible for ISI examination method that is credited for aging management; and which alternative aging management approach (if any) will be credited in addition to the Water Chemistry Program if it is determined that the internal surfaces of the reactor recirculation pump thermal barrier are inaccessible for inspection.

The applicant responded to RAI 3.1.2.3.3.2-1 by letter dated August 27, 2008. In its response, the applicant stated that the internal surfaces of the reactor recirculation pump thermal barrier consist of the bored channels that provide the flowpath for the Reactor Building Closed Cooling Water (RBCCW). The applicant also stated that these internal surfaces are inaccessible for inspection, and, as such, the ISI Program is not an appropriate aging management program for loss of material.

The applicant stated that an appropriate aging management approach is to credit the Closed Cooling Water (CCW) Chemistry Program supplemented by the CPEI. The applicant further stated that as described in LRA Section B.2.14, the combination of these two programs will manage loss of material for stainless steel components exposed to closed cooling water. The applicant also stated that although the internal surfaces of the reactor recirculation pump thermal barrier are inaccessible for inspection, the CPEI will inspect other components of like material exposed to CCW to confirm that loss of material has been effectively mitigated or to detect any degradation that is occurring. The applicant indicated that this is consistent with

GALL Item VII.C2- 10, which is for stainless steel components exposed to closed cycle cooling water and recommends the closed cooling water program for management of loss of material.

The applicant revised the line entry in Table 3.1.2-3 to credit the CPEI in place of the ISI Program. The applicant also revised the footnote from H to E. Since the applicant has changed the footnote from H to E, the discussion in LRA Section 3.1.2.2.2.3 is also revised to note the use of CPEI with the CCW Chemistry Program.

The staff reviewed the applicant's Closed Cooling Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.7, found that the applicant's Closed Cooling Water Chemistry Program provides mitigation for the aging effect of loss of material due to pitting and crevice corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the applicant's CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The applicant's CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to pitting and crevice corrosion, if it should occur in the selected components. Because the Closed Cooling Water Chemistry Program provides mitigation and the CPEI provides detection for loss of material due to pitting, and crevice corrosion, the staff finds the applicant's LRA changes and the applicant's use of the Closed Cooling Water Chemistry Program and the CPEI for managing loss of material due to pitting, and crevice corrosion for stainless steel reactor recirculation pump thermal barrier surfaces that are exposed to the treated, closed-cycle cooling water environment in the reactor pressure vessel and in the reactor coolant system pressure boundary to be acceptable. The inspection of an alternative location is acceptable because the alternative location has a material and an environment equivalent to the reactor recirculation pump thermal barriers.

In LRA Table 3.1.2-3, the applicant includes its plant-specific AMR on management of cracking and flaw growth in the internal reactor recirculation pump thermal barrier surfaces that are exposed to the treated, closed-cycle cooling water environment. In these AMRs, the applicant identifies that cracking and flaw growth is an applicable AERM for the internal component surfaces that are exposed to the treated, closed-cycle cooling water environment. In these AMRs, the applicant credits a combination of the Closed Cooling Water Chemistry Program and BWR Stress Corrosion Cracking Program to manage cracking and flaw growth in the internal thermal barrier surfaces that are exposed to the treated, closed-cycle cooling water environment.

The staff verified that the applicant had included a plant-specific AMR on cracking and flaw growth in the internal surfaces of the reactor recirculation pump thermal barriers that are exposed to the treated, closed-cycle cooling water environment, and that, in this AMR, the applicant credited both its Closed Cooling Water Chemistry Program and BWR Stress Corrosion Cracking Program to manage cracking and flaw growth in the internal component surfaces that are exposed to closed-cycle cooling water.

The staff was initially of the opinion that it might not be appropriate to credit the BWR Stress Corrosion Cracking Program for aging management of cracking and flaw growth in the internal surfaces of the reactor recirculation pump thermal barriers because they may be located in areas that are inaccessible for examination.

In RAI 3.1.2.3.3.3-1, Part A dated July 23, 2008, the staff asked the applicant to identify the type of examinations that will be used under the BWR Stress Corrosion Cracking Program to monitor for and detect cracking and flaw growth in the internal surfaces of the recirculation pump thermal barriers that are exposed to closed-cycle cooling water, and to clarify whether the internal surfaces of the reactor recirculation pump thermal barriers are accessible for the examination method that is credited for aging management.

The staff also noted that the applicant has credited the Closed Cooling Water Chemistry Program to manage cracking and flaw growth in internal surfaces of these components. The staff noted, however, that these components are made of alloy steel without internal stainless steel or nickel alloy cladding. The staff noted that Closed Cooling Water Chemistry Program would only be a valid program to credit for management of cracking/flaw growth if the mechanisms inducing cracking and flaw growth were chemistry-related or corrosion-related cracking/flaw growth mechanisms, such as stress corrosion cracking (SCC and its forms such as PWSCC or IGSCC) or IGA. Thus, the staff was of the opinion that the Closed Cooling Water Chemistry Program would only be a valid program to credit if the cracking/flaw growth was induced by either SCC, PWSCC, IGSCC or IGA. In Part B, the staff asked the applicant to clarify the aging mechanisms that could induce cracking and flaw growth in the internal surfaces of the reactor recirculation pump thermal barriers, and based on these mechanisms, to provide its basis why the Closed Cooling Water Chemistry is considered to be a valid AMP for managing cracking and flaw growth in these components.

In its response to RAI 3.1.2.3.3.3-1, Part A dated August 27, 2008, the applicant stated that the internal surfaces of the reactor recirculation pump thermal barrier consist of the bored channels that provide the flowpath for the Reactor Building Closed Cooling Water (RBCCW). The applicant also stated that these internal surfaces are inaccessible for inspection; as such, the BWR Stress Corrosion Cracking (SCC) Program is not an appropriate aging management program for cracking.

The applicant further stated that "an appropriate aging management approach is to credit the Closed Cooling Water (CCW) Chemistry Program supplemented by the CPEI. As described in LRA Section B.2.14, these programs will manage cracking for stainless steel components exposed to closed cooling water. Although the internal surfaces of the reactor recirculation pump thermal barrier are inaccessible for inspection, the CPEI will inspect other components of like material exposed to CCW to confirm that cracking has been effectively mitigated or to detect any degradation that is occurring."

In response to RAI 3.1.2.3.3.3-1, Part B dated August 27, 2008, the applicant stated that "the aging mechanism capable of inducing cracking and flaw growth in the internal surfaces of the reactor recirculation pump thermal barriers is stress corrosion cracking (SCC). The pump thermal barrier is susceptible to SCC because it is made of stainless steel and is subjected to a closed cycle cooling water environment. Cracking due to SCC on the internal surfaces of the thermal barrier is mitigated by water chemistry control via the Closed Cooling Water Chemistry Program. This is consistent with GALL Item VII.C2-11, which is for stainless steel components exposed to closed cycle cooling water. The GALL item recommends the closed cooling water program for management of cracking due to SCC. It is noted that there is no direct comparison in GALL Section IV for the internal surfaces of the thermal barrier because GALL Section IV does not address a closed cooling water environment.

The applicant revised Table 3.1.2-3 for CASS pump thermal barrier to delete BWRSCC Program as the verification program for Closed Cycle Cooling Water Chemistry and instead

credits the CPEI as the verification program. The applicant also revised the footnote H to footnote E.

The staff reviewed the applicant response and the changes to the LRA. The GALL Report Item VII.C2-11 addresses stainless components in an environment of closed cycle cooling water > 140^0F with an aging effect of cracking due to SCC. For this line, the GALL Report recommends GALL AMP XI.M21, "Closed Cycle Cooling Water System," to manage the aging effects. The applicant is crediting its Closed Cycle Cooling Water System program, which is consistent with the GALL Report recommendation, and, in addition, is crediting the Chemistry Program Effectiveness Inspection. The staff evaluates the ability of the Closed Cycle Cooling Water System Program and CPEI to manage cracking in these components in SER Sections 3.0.3.2.7 and 3.0.3.1.10 respectively. On the basis that the applicant is consistent with the GALL Report, the staff finds that applicant response acceptable and concludes that the Closed Cycle Cooling Water System Program and CPEI will adequately manage the aging effect of cracking due to SCC in CASS reactor recirculation pump thermal barrier in an environment of closed cycle cooling water > 140^0F during the period of extended operation.

In LRA Table 3.1.2-3, the applicant includes its plant-specific AMR on management of cracking/flaw growth in the unclad steel N15 reactor vessel (RV) drain nozzles that are exposed internally to the treated water environment of the reactor coolant. In these AMRs, the applicant identifies that cracking/flaw growth is an applicable AERM for the internal component surfaces that are exposed to the treated water environment of the reactor coolant. In these AMRs, the applicant credits a combination of BWR Water Chemistry Program and the BWR Penetrations Program for management of cracking/flaw growth in the internal component surfaces that are exposed to the treated water environment of the reactor coolant.

The staff verified that, in its AMR for managing cracking and flaw growth in the N15 RV drain nozzles, the applicant credits a combination of its BWR Water Chemistry Program and the BWR Penetrations Program to manage this aging effect.

The staff verified that in AMP B.2.8 the applicant identifies that the BWR Penetrations Program is credited for managing cracking that is projected to occur in the SSES RV penetration nozzles and that the program is designated as an AMP that is consistent with the program elements in GALL AMP XI.M8, "BWR Penetrations," with an exception to include additional RV penetrations (including the N15 RV drain nozzles) within the scope of the program. In RAI B.2.8-1 by letter dated July 23, 2008, the staff asked the applicant to provide its basis for extending the scope of the BWR Penetrations Program to the RV drain nozzles. The scope of RAI B.2.8-1 is also applicable to the staff's assessment of the applicant's AMR item on cracking and flaw growth of the N15 RV drain nozzles and their associated nozzle-to-vessel welds.

The staff noted that the applicant has also credited the BWR Water Chemistry Program to manage cracking and flaw growth in these components. The staff noted, however, that these components are made of alloy steel without internal stainless steel or nickel alloy cladding. The staff noted that BWR Water Chemistry Program would only be a valid program to credit for management of cracking/flaw growth if the mechanisms inducing cracking and flaw growth were chemistry-related or corrosion-related cracking/flaw growth mechanisms, such as stress corrosion cracking (SCC and its forms such as PWSCC or IGSCC) or IGA. To date, SCC or IGA have not been identified as aging mechanisms of concern for steel materials (including carbon steels and alloy steels).

The staff noted that the N15 RV drain nozzles are designated as alloy steel nozzles without stainless steel or nickel alloy cladding. Thus, the staff was of the opinion that the BWR Water Chemistry Program would only be a valid program to credit if the cracking/flaw growth was induced by SCC, PWSCC, IGSCC or IGA. In RAI 3.1.2.3.3.4-1, Part A by letter dated July 23, 2008, the staff asked the applicant to clarify the weld material that was used to fabricate the N15 RV drain nozzle-to-vessel welds. In RAI 3.1.2.3.3.4-1, Part B, the staff asked the applicant to clarify the aging mechanisms that could induced cracking and flaw growth in the N15 RV drain nozzles and their associated nozzle-to-vessel welds, and based on these mechanisms, to provide its basis why the BWR Water Chemistry is considered to be a valid AMP for managing cracking and flaw growth in these components.

In its response to RAI 3.1.2.3.3.4-1 dated August 27, 2008, the applicant stated:

> Part A. The N15 RV drain nozzles were constructed by boring a hole through the bottom head of the reactor vessel and then welding a short length of a forged pipe (nozzle) to the outside surface of the bottom head. The weld material between the low alloy nozzle (SA-508 Class 1) and the low alloy vessel (SA-533 Grade B) is low alloy steel, compatible with the vessel and nozzle materials. The weld consists of two parts; the weld buildup on the outside diameter of the bottom head of the vessel, and the weld between the nozzle and the weld buildup. The weld buildup material is E8018-G, trade name Atom Arc 8018NM, conforming to the current specification for E8018-NM1. The material for the weld between the nozzle and the weld buildup is equivalent to E8018-NM, trade name Adcom 1NMM.
>
> The line entry for drain nozzle N15 in LRA Table 3.1.2-1 (LRA page 3.1-45) identifies the drain nozzle as low alloy steel with partial stainless steel (SS) clad. The SS cladding is only on the inside diameter of the bottom head of the vessel, extending just slightly into the bore from the inside diameter of the vessel. There is no cladding on the inside diameter of the vessel bore hole, the weld, or the drain nozzle.
>
> Part B. The aging mechanism that is capable of inducing cracking and flaw growth in the N15 RV drain nozzle and associated weld is crack initiation and flaw growth due to thermal and mechanical loading. The BWR Water Chemistry Program does not mitigate cracking caused by this mechanism. LRA Table 3.1.2-1 and line item 3.1.1-40 in Table 3.1.1 are revised to remove the BWR Water Chemistry Program from this entry.

The staff reviewed the applicant's response and finds, that because the material of the drain nozzle is alloy steel, cracking is caused by thermal and mechanical loading, and BWR water chemistry does not mitigate cracking caused by this mechanism. Therefore, the staff finds it acceptable to delete the Water Chemistry Program from this line item. The BWR Penetration Program includes inspection and flaw evaluation in conformance with the guidelines of NRC-approved BWRVIP reports BWRVIP-49 and BWRVIP-27, and is consistent with the GALL AMP XI.M8. Therefore, based on the review of the BWR Penetrations Program as documented in SER Section 3.0.3.2.3, the staff finds that the BWR Penetrations Program will adequately manage the aging effect of cracking in the N15 penetration nozzle.

In LRA Table 3.1.2-3, the applicant proposed to manage cracking in carbon steel piping and fittings (< 4 inch) and in carbon steel valves (<4 inch) in an environment of treated water using

the Small Bore Class 1 Piping Inspection, alone. The applicant cited generic Note H for these AMR results, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The staff noted that the component, material, environment and aging effect combination for these lines appears to be the same as in the GALL Report line IV.C1-1 (where the material is stainless steel or steel). In a letter dated July 15, 2008, the staff issued RAI 3.1-7 asking the applicant to explain why Note H was used for these lines and to justify why the AMP proposed by the applicant provides acceptable aging management for these components.

The applicant responded to RAI 3.1-7 in a letter dated August 15, 2008. In their response, the applicant revised the results for these two AMR result lines in LRA Table 3.1.2-3. In the revision, the applicant changed the GALL Report reference for these two lines from "N/A" to "IV.C1-1" and changed the Table 1 item reference from "N/A" to "3.1.1-48." The applicant also changed from citing Note H to citing Note E for these components and added the ISI Program as an additional AMP to manage the aging effect of cracking in these components. The staff's evaluation of the applicant's response to RAI 3.1-7 and the related LRA changes is documented in SER Section 3.1.2.1.2.

In LRA Table 3.1.2-3 the applicant includes its plant-specific AMR items for managing cracking in carbon steel piping, piping components, and piping elements, and valve bodies that are greater or equal to than 4 inches in diameter and that are exposed to a treated water environment. In these AMRs, the applicant credits its Inservice Inspection Program for aging management of cracking in the surfaces that are exposed to treated water. The staff noted that the applicant's Inservice Inspection Program is a condition monitoring program that is based on compliance with the requirements of 10 CFR 50.55a and the ASME Code Section XI and that the applicant's program is based on conformance with the staff's recommended program elements in GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." Based on this review the staff finds that the applicant has provided an acceptable basis for crediting its Inservice Inspection Program to manage cracking in these components because these components are ASME Code Class components. The staff evaluates the ability of the Inservice Inspection Program to manage aging in ASME Code Class components in SER Section 3.0.3.2.1

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the RV, RV internals, and reactor coolant system components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2 Aging Management of Engineered Safety Features

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

- Residual Heat Removal (RHR) System
- Reactor Core Isolation Cooling (RCIC) System
- Core Spray System
- High Pressure Coolant Injection (HPCI) System
- Containment and Suppression System
- Containment Atmosphere Control System
- Standby Gas Treatment System (SGTS)

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the engineered safety features components and component groups. LRA Table 3.2.1, "Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL Report," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the engineered safety features components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry OE in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry OE included a review of the GALL Report and OE issues identified since the issuance of the GALL Report.

3.2.2 Staff Evaluation

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

The staff conducted an onsite audit of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.2.2.1.

In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.2.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.2.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging

effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.2.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's OE to verify the applicant's claims.

Table 3.2-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.2 and addressed in the GALL Report.

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

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel piping, piping components, and piping elements in emergency core cooling system (3.2.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.2.2.2.1)
Steel with stainless steel cladding pump casing exposed to treated borated water (3.2.1-2)	Loss of material due to cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks"	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.2.2.2.2)
Stainless steel containment isolation piping and components internal surfaces exposed to treated water (3.2.1-3)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable. The applicant addressed these components under GALL Report Item number 3.2.1-5. (See SER Section 3.2.2.2.3.1)
Stainless steel piping, piping components, and piping elements exposed to soil (3.2.1-4)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to SSES (See SER Section 3.2.2.2.3.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.2.1-5)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.2.2.2.3.3)
Stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.2.1-6)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program (B.2.33) and Lubricating Oil Inspection Program (B.2.25)	Consistent with GALL Report (See SER Section 3.2.2.2.3.4)
Partially encased stainless steel tanks with breached moisture barrier exposed to raw water (3.2.1-7)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes	Not applicable	Not applicable (See SER Section 3.2.2.2.3.5)
Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal) (3.2.1-8)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	See SER Section 3.2.2.2.3.6
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil (3.2.1-9)	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Piping Corrosion Program (B.2.13)	Consistent with GALL Report (See SER Section 3.2.2.2.4.1)
Stainless steel heat exchanger tubes exposed to treated water (3.2.1-10)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Heat Exchanger Inspection (B.2.24)	Consistent with GALL Report (See SER Section 3.2.2.2.4.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Elastomer seals and components in standby gas treatment system exposed to air - indoor uncontrolled (3.2.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes	System Walkdown (B.2.32)	Consistent with GALL Report (See SER Section 3.2.2.2.5)
Stainless steel high-pressure safety injection (charging) pump miniflow orifice exposed to treated borated water (3.2.1-12)	Loss of material due to erosion	A plant-specific aging management program is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.2.2.2.6)
Steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled (internal) (3.2.1-13)	Loss of material due to general corrosion and fouling	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	See SER Section 3.2.2.2.7
Steel piping, piping components, and piping elements exposed to treated water (3.2.1-14)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.2.2.2.8.1)
Steel containment isolation piping, piping components, and piping elements internal surfaces exposed to treated water (3.2.1-15)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable. The applicant addressed these components under GALL Report Item number 3.2.1-14. (See SER Section 3.2.2.2.8.2.)
Steel piping, piping components, and piping elements exposed to lubricating oil (3.2.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program (B.2.33) and Lubricating Oil Inspection Program (B.2.25)	Consistent with GALL Report (See SER Section 3.2.2.2.8.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil (3.2.1-17)	Loss of material due to general, pitting, crevice, and MIC	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Not applicable	Not applicable to SSES (3.2.2.2.9)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.2.1-18)	Cracking due to SCC and IGSCC	BWR Stress Corrosion Cracking and Water Chemistry	No	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.2.2.1.4)
Steel piping, piping components, and piping elements exposed to steam or treated water (3.2.1-19)	Wall thinning due to FAC	Flow-Accelerated Corrosion	No	Flow-Accelerated Corrosion (B.2.11)	Consistent with GALL Report
Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated water (borated or unborated) > 250°C (> 482°F) (3.2.1-20)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable. (See SER Section 3.2.2.1.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.2.1-21)	Cracking due to cyclic loading, SCC	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Steel closure bolting exposed to air with steam or water leakage (3.2.1-22)	Loss of material due to general corrosion	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Steel bolting and closure bolting exposed to air - outdoor (external), or air - indoor uncontrolled (external) (3.2.1-23)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel closure bolting exposed to air - indoor uncontrolled (external) (3.2.1-24)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Not applicable	Consistent with GALL Report (See SER Section 3.0.3.2.5)
Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water > 60°C (> 140°F) (3.2.1-25)	Cracking due to SCC	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.2.1-26)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to closed cycle cooling water (3.2.1-27)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.2.2.1.5.)
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water (3.2.1-28)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.2.2.1.5.)
Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.2.1-29)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.2.2.1.5.)
Stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water (3.2.1-30)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Piping Corrosion (B.2.13), and Heat Exchanger Inspection (B.2.24)	Consistent with GALL Report (See SER Section 3.2.2.1.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
External surfaces of steel components including ducting, piping, ducting closure bolting, and containment isolation piping external surfaces exposed to air - indoor uncontrolled (external); condensation (external) and air - outdoor (external) (3.2.1-31)	Loss of material due to general corrosion	External Surfaces Monitoring	No	System Walkdown (B.2.32), and Supplementary Piping/Tank Inspection (B.2.28)	Consistent with GALL Report (See SER Section 3.2.2.1.3)
Steel piping and ducting components and internal surfaces exposed to air - indoor uncontrolled (Internal) (3.2.1-32)	Loss of material due to general corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Preventive Maintenance Activities – HPCI/RCIC Turbine Casings (B.2.48), System Walkdown (B.2.32), and Supplementary Piping/Tank Inspection (B.2.28)	Consistent with GALL Report (See SER Section 3.2.2.1.3)
Steel encapsulation components exposed to air - indoor uncontrolled (internal) (3.2.1-33)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Steel piping, piping components, and piping elements exposed to condensation (internal) (3.2.1-34)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Addressed under 3.2.1-32 (See SER Section 3.2.2.1.1)
Steel containment isolation piping and components internal surfaces exposed to raw water (3.2.1-35)	Loss of material due to general, pitting, crevice, and MIC, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to raw water (3.2.1-36)	Loss of material due to general, pitting, crevice, galvanic, and MIC, and fouling	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, and piping elements exposed to raw water (3.2.1-37)	Loss of material due to pitting, crevice, and MIC	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Stainless steel containment isolation piping and components internal surfaces exposed to raw water (3.2.1-38)	Loss of material due to pitting, crevice, and MIC, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Stainless steel heat exchanger components exposed to raw water (3.2.1-39)	Loss of material due to pitting, crevice, and MIC, and fouling	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report
Steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water (3.2.1-40)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report
Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.2.1-41)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching Inspection Program (B.2.29)	Consistent with GALL Report
Gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water (3.2.1-42)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching Inspection Program (B.2.29)	Consistent with GALL Report
Gray cast iron piping, piping components, and piping elements exposed to soil (3.2.1-43)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Gray cast iron motor cooler exposed to treated water (3.2.1-44)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Aluminum, copper alloy > 15% Zn, and steel external surfaces, bolting, and piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-45)	Loss of material due to Boric acid corrosion	Boric Acid Corrosion	No	Not applicable	Not applicable to BWRs
Steel encapsulation components exposed to air with borated water leakage (internal) (3.2.1-46)	Loss of material due to general, pitting, crevice and boric acid corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not applicable to BWRs
Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated borated water > 250°C (> 482°F) (3.2.1-47)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to BWRs
Stainless steel or stainless-steel-clad steel piping, piping components, piping elements, and tanks (including safety injection tanks/accumulators) exposed to treated borated water > 60°C (> 140°F) (3.2.1-48)	Cracking due to SCC	Water Chemistry	No	Not applicable	Not applicable to BWRs
Stainless steel piping, piping components, piping elements, and tanks exposed to treated borated water (3.2.1-49)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Not applicable	Not applicable to BWRs
Aluminum piping, piping components, and piping elements exposed to air - indoor uncontrolled (internal/external) (3.2.1-50)	None	None	No	None	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Galvanized steel ducting exposed to air - indoor controlled (external) (3.2.1-51)	None	None	No	None	Consistent with GALL Report
Glass piping elements exposed to air - indoor uncontrolled (external), lubricating oil, raw water, treated water, or treated borated water (3.2.1-52)	None	None	No	None	Consistent with GALL Report
Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.2.1-53)	None	None	No	None	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.2.1-54)	None	None	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.2.1-55)	None	None	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)
Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to gas (3.2.1-56)	None	None	No	Not applicable	Not applicable to SSES (See SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-57)	None	None	No	Not applicable	Not applicable to BWRs

The staff's review of the engineered safety features component groups followed any one of several approaches. One approach, documented in SER Section 3.2.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.2.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.2.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the engineered safety features components is documented in SER Section 3.0.3.

3.2.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.2.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the engineered safety features components:

- BWR Water Chemistry Program
- Flow-Accelerated Corrosion (FAC) Program
- Bolting Integrity Program
- Piping Corrosion Program
- Fire Water System Program
- Chemistry Program Effectiveness Inspection
- Heat Exchanger Inspection
- Lubricating Oil Inspection
- Supplemental Piping/Tank Inspection
- Selective Leaching Inspection
- System Walkdown Program
- Lubricating Oil Analysis Program
- Preventive Maintenance Activities - RCIC/HPCI Turbine Casings

LRA Tables 3.2.2-1 through 3.2.2-7 summarize AMRs for the engineered safety features components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

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

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

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

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

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the engineered safety features ESF components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as

identified in LRA Table 3.2.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsections that follow.

3.2.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.2.1, item 20, the applicant indicates that the corresponding AMR result line in the GALL Report is not applicable because there are no CASS components in the ESF systems for SSES that are exposed to treated water > 250°C (>482°F). The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES do not have ESF CASS components in the environment stated above. Therefore, the staff finds the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 22, the applicant states that the corresponding AMR result line are addressed under item 3.2.1-23. The staff reviewed the documentation supporting the applicant's AMR evaluation in items 3.1.1-23, and no SSES AMR line items roll up to 3.1.1-22. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 25, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because there are no stainless steel piping and piping components in the ESF systems for SSES that are exposed to closed-cycle cooling water > 60°C (>140°F). The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES does not have this commodity group in the ESF System. Therefore, the staff finds the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 26, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because there are no steel piping and piping components in the ESF systems for SSES that are exposed to closed-cycle cooling water. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that this line item is not applicable to SSES. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 33, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because the ESF systems include no steel encapsulation components. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 34, the applicant states that the corresponding AMR result line are addressed under item 3.2.1-32. The staff reviewed the documentation supporting the applicant's AMR evaluation in items 3.1.1-32, and no SSES AMR line items roll up to 3.1.1-34. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 35, the applicant indicates for that the corresponding AMR result line, there are no steel containment isolation piping or components exposed to raw water in the ESF systems for SSES. In addition, the applicant indicated that this item is applied to loop seal valves exposed to raw water in the SGTS. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES has no steel containment isolation piping or components exposed to raw water in the ESF System. In addition, the staff reviewed the Table 2 items which correspond to loop seal valves exposed to raw water in the SGTS, and finds the applicant's management of these line item components consistent with the GALL Report. Therefore, the staff agrees with the applicant's treatment of line item 3.2.1-35.

In LRA Table 3.2.1, items 37 and 38, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because there are no stainless steel piping, piping components, or piping elements exposed to raw water in the ESF Systems, and no stainless steel containment isolation piping or components exposed to raw water in the ESF Systems respectively. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES has no in-scope stainless steel piping, piping components, piping elements, containment isolation piping or components in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 43, the applicant indicates for this corresponding AMR result line in the GALL Report, there are no gray cast iron piping, piping components, or piping elements exposed to soil in the ESF systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that no SSES components in the ESF systems align to this item. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report, and finds this line item as not applicable to SSES.

In LRA Table 3.2.1, item 44, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because there are no gray cast iron motor coolers exposed to treated water in the ESF systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES has no in-scope gray cast iron motor coolers exposed to treat water in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 54, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because there are no steel components exposed to indoor air (controlled) environments in ESF systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that no components under this commodity group exist in the ESF. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 55, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because there are no steel or stainless steel components embedded in concrete in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.2.1, item 56 the applicant states that the corresponding AMR result line in the GALL Report is not applicable because there are no steel, stainless steel, or cooper alloy components in the ESF systems for SSES that are exposed to gas. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES has no in-scope steel, stainless steel, or cooper alloy components in the ESF that are exposed to gas. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

3.2.2.1.2 Reduction of Heat Transfer due to Fouling

In LRA Table 3.2.2.-1, the applicant stated that reduction of heat transfer of RHR heat exchanger copper alloy tubes in an external environment of treated water is managed by the Piping Corrosion Program.

The staff noted that the applicant applied Note E to this item. The applicant referenced Table 3.2-1, item 3.2.1-30 and GALL Report Volume 2, item V.A-11. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M21, "Closed-Cycle Cooling Water System," the applicant proposed using the Piping Corrosion Program. The staff also noted that the internal environment of the tubes is raw water and the heat exchanger is part of the GL 89-13 Program.

The GALL recommended AMP XI.M21, Closed-Cycle Cooling Water System, recommends preventive measures to minimize corrosion and testing and inspection to monitor the effects of corrosion. The staff reviewed the Piping Corrosion Program, which includes preventive measures such as chemical treatment and cleaning, and testing and inspection on a periodic basis as per the commitments in response to NRC GL 89-13. Based on this review, the staff finds that the Piping Corrosion program will adequately manage the aging effect of reduction of heat transfer of copper alloy heat exchanger tubes in an external environment of treated water for the period of extended operation.

In LRA Tables 3.2.2.-2 and 3.2.2-4, the applicant states that reduction of heat transfer of RCIC and HPCI heat exchanger copper alloy tubes in an internal environment of treated water is managed by the Heat Exchanger Inspection Program.

The staff noted that the applicant applied Note E to this item. The applicant referenced Table 3.2-1, item 3.2.1-30 and GALL Report Volume 2, item V.A-11. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M21, "Closed-Cycle Cooling Water System," the applicant proposed using the Heat Exchanger Inspection Program.

The GALL recommended AMP XI.M21, Closed-Cycle Cooling Water System, recommends preventive measures to minimize corrosion and testing and inspection to monitor the effects of corrosion, whereas the applicant is proposing only a one-time inspection activity. The staff issued RAI 3.2.2.1-1 dated July 23, 2008, requesting the applicant to justify how the one-time heat exchanger inspection activity by itself will manage the aging effect of reduction in heat transfer, without preventive measures to minimize corrosion, such as maintaining treated water chemistry control.

In its response to RAI 3.2.2.1-1dated August 22, 2008, the applicant stated that as indicated in Tables 3.2.2-2 and 3.2.2-4, the BWR Water Chemistry Program is credited for managing loss of material for copper alloy heat exchanger tubes exposed to treated water. The applicant also stated that since the BWR Water Chemistry Program does not contain measures for detection of aging effects through inspection, it is not credited for managing reduction in heat transfer; however, it is recognized that the same preventive actions by which the water chemistry program manages loss of material also mitigates the conditions that could result in reduction in heat transfer. The applicant further stated that due to the BWR water chemistry control, fouling of heat exchanger tubes is not expected to occur. Therefore, the applicant concluded that as stated in LRA Section B.2.24, the Heat Exchanger Inspection will provide direct evidence as to whether, and to what extent, reduction in heat transfer has occurred, or is likely to occur, that could result in a loss of intended function.

The staff noted that in LRA Tables 3.2.2-2 and 3.2.2-4, the BWR Water Chemistry Program is credited for managing loss of material of RCIC turbine oil coolers and HPCI lube oil coolers. For these same coolers, the applicant has credited Heat Exchanger Inspection Program for reduction of heat transfer. On the basis that water chemistry is maintained to minimize corrosion and fouling, the staff finds the use of Heat Exchanger Inspection Program acceptable for managing the aging effects of reduction of heat transfer for copper alloy heat exchanger tubes exposed to treated water and finds the applicant response acceptable. The evaluation of the Heat Exchanger Program is documented in SER Section 3.0.3.1.12.

3.2.2.1.3 Loss of material due to general corrosion

In LRA Table 3.2.1, Item 3.2.1-32, addresses loss of material due to general corrosion for steel *piping and ducting components and internal surfaces exposed to air (indoor uncontrolled* [internal]) in the Standby Gas Treatment System. The GALL Report recommends GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to manage this aging effect. The AMR line items in LRA Table 2 that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff reviewed the AMR results lines that reference Note E and determines that the material, environment, and aging effect are consistent with the GALL Report.

The staff reviewed the applicant's AMP B.2.32 "System Walkdown Program" and its evaluation is documented in SER Sections 3.0.3.2.14. The staff determined that this aging management program which include surveillance activities and observations that are adequate to manage loss of material due to general corrosion for steel components exposed to ventilation (internal) addressed by this AMR are consistent with those activities recommend by GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." However the applicant is crediting the AMP B.2.32, which performs visual inspections of the external surfaces only, for the internal surfaces of fan and filter housings, piping, valve bodies, plenums, and SGTS filter unit enclosures. The staff felt that additional information was needed and therefore, by letter dated July 23, 2008, the staff issued RAI 3.x.2.1-1 requesting the applicant to justify the basis for crediting AMP B.2.32, which performs visual inspections of external surfaces only, for the internal surfaces of steel ventilation system enclosures and for piping components in ventilation environments.

In its response to RAI 3.x.2.1-1 dated August 22, 2008, the applicant stated that the internal ventilation environment of that these components are exposed to is the same as the

environment the external surfaces are exposed to because this system is normally in a standby mode in which the relevant temperature and humidity is the same on the external and internal surface. The staff noted that crediting an external visual inspection for managing aging of the internal surface if the environments are the same is consistent with the recommendations given in the program element, "scope of program", of GALL AMP XI.M36 "External Surfaces Monitoring", in which a visual inspection of the external surfaces may be representative of the internal surfaces if the environment is the same for the external and internal surfaces. The staff noted that internal surfaces of the SGTSfilter unit enclosure and piping may experience a different environment at the air/water interface of the mist eliminator loop seal, so the applicant is supplementing the AMP B.2.32 "System Walkdown Program" with the AMP B.2.28 "Supplemental Piping/Tank Inspection" and the staff confirmed that the AMP B.2.28 will provide verification if degradation has occurred on the internal surfaces of these components and the effectiveness of the AMP B.2.32 "System Walkdown Program" for managing loss of material. On the basis of its review, the staff finds the applicable portion of the applicant's response that references GALL Item V.B-1 to be acceptable because (1) the environments of the external surface and internal surface is the same and consistent with the recommendations provided in GALL that an visual inspection of the external surface can be credited for managing aging of the internal surfaces if the environments are the same and (2) the applicant has credited a one-time inspection to verify if degradation has occurred and the effectiveness of the Systems Walkdown Program when the environment of the external surface may be different than the environment of the internal surface. On this basis, the staff finds the AMR results for this line item acceptable.

In LRA Tables 3.2.2-1 and 3.2.2-2, the applicant states that loss of material of RHR and RCIC steel piping in an internal environment of ventilation and external environment of indoor air is managed by the Supplementary Piping/Tank Inspection Program.

The staff noted that the applicant applied Note E to this item. The applicant referenced Table 3.2-1, items 3.2.1-31 and 3.2.1-32 and GALL Report Volume 2, items VD2-16 and VD2-2. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M39, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," and AMP XI.M36, "External Surface Monitoring", the applicant proposed using the Supplementary Piping/Tank Inspection Program.

The LRA also references footnote 0203, which states that the environment is an aggressive air/water interface in the suppression pool. The staff determined that in this environment, loss of material is due to general, crevice and pitting corrosion. The Supplementary Piping/Tank Inspection Program uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection is performed at very specific locations of air/water interface, and employs more conservative inspection techniques than the visual inspection of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and the External Surfaces Monitoring Program, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

In Table 3.2.2-5, the LRA states that loss of material of containment and suppression system steel downcomers in an external environment of indoor air is managed by the Supplementary Piping/Tank Inspection Program.

The staff noted that the applicant applied Note E to this item. The applicant referenced Table 3.2-1, item 3.2.1-31 and GALL Report Volume 2, item VB-3. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP AMP XI.M36, "External Surface Monitoring", the applicant proposed using the Supplementary Piping/Tank Inspection Program.

The LRA also references footnote 0212, which states that the environment is an aggressive air/water interface in the suppression pool. The staff determined that in this environment, loss of material is due to general, crevice and pitting corrosion. The Supplementary Piping/Tank Inspection Program uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection is performed at very specific locations, and employs more conservative inspection techniques than the visual inspection of External Surfaces Monitoring Program, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

In Table 3.2.2-7, the LRA states that loss of material of SGTSsteel filter unit enclosure and skimmer surge tanks in an internal environment of ventilation is managed by the Supplementary Piping/Tank Inspection Program.

The staff noted that the applicant applied Note E to this item. The applicant referenced Table 3.2-1, item 3.2.1-32 and GALL Report Volume 2, item V.B-1. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M39, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," the applicant proposed using the Supplementary Piping/Tank Inspection Program.

The LRA also references footnote 0215, which states that the environment is an aggressive air/water interface in the suppression pool. The staff determined that in this environment, loss of material is due to crevice and/or pitting corrosion and MIC (at the airwater interface in the mist eliminator loop seals), and galvanic corrosion (at contact points with the mist eliminator housing. The Supplementary Piping/Tank Inspection Program uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection is performed at very specific locations, and employs more conservative inspection techniques than the visual inspection of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

LRA Table 3.3.1, line items 3.2.1-32 addresses the results of an AMR for Steel piping and ducting components exposed internal air – indoor uncontrolled. The applicant addresses cast iron and carbon steel piping, pump casings, rupture disks and valve bodies in the Reactor Core Isolation Cooling System and High Pressure Coolant Injection System. The applicant states

that the aging effect requiring management is loss of material and proposes to use the Preventive Maintenance Activities – RCIC/HPCI Turbine Casings to manage the effects of aging.

The applicant has indicated generic Note E for this line item which is consistent with the GALL report for material, environment, and aging effect, but a different aging management program. The staff noted that the GALL Report recommends GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" for GALL AMR Item V.D2-16. The staff noted that the GALL AMP XI.M38 recommends periodic visual inspections during maintenance and surveillance activities to detect age-related degradation, such as loss of material due to general corrosion.

The staff's evaluation of the AMP B.2.48 is documented in SER Section 3.0.3.3.3. The staff noted that this program is a plant-specific program that performs a periodic visual inspection of the carbon steel and cast iron internal surfaces of the RCIC and HPCI pump turbine casings (and gland cases) and the in-scope piping and piping components in steam lines downstream from the steam admission valves, by qualified personnel. The staff noted that the visual inspections being performed will detect rust, discoloration and other signs of degradation that may be indicative of wall-thinning and loss of material. The staff further noted that if unacceptable visual indications of wall-thinning or loss of material the applicant will initiate appropriate corrective actions. The staff determined that a visual inspection will be capable of detecting loss of material, which is consistent with the inspection techniques recommended by GALL AMP XI.M38. On the basis that the applicant will be performing periodic visual inspections on the components within the scope of this program and will initiate appropriate corrective actions if unacceptable loss of material or wall-thinning has occurred, the staff finds the AMR results for this line item acceptable.

3.2.2.1.4 Cracking due to Stress Corrosion Cracking (SCC) and Intergranular Stress Corrosion Cracking (IGSCC)

LRA Tables 3.2.2-2 and 3.2.2-4 address stainless steel tubing in an environment of treated water greater than 60°C (>140°F) in the reactor core isolation cooling (RCIC) system and in the HPCI system. The applicant specified the BWR Water Chemistry Program, alone, to manage the aging effect of cracking due to SCC or IGSCC. For these AMR result lines, the applicant referred to LRA Table 3.2.1, item 3.2.1-18, and cited generic note A, indicating that the results are consistent with the GALL Report. The applicant also included a plant-specific note stating that these results apply only to stainless steel tubing in the steam supply to RCIC and HPCI pump turbines up to the steam admission valves that are maintained at temperature >140 °F.

The staff noted that for the corresponding line in SRP-LR Table 3.2-1 and in GALL Report, Volume 1, Table 2, the recommended AMPs are the BWR Stress Corrosion Cracking program and the Water Chemistry program. The staff also noted that the BWR Stress Corrosion Cracking program applies only to stainless steel piping components that are greater than 4 inch nominal pipe size; and therefore, it is not applicable for stainless steel tubing. Because the applicant did not recommend an inspection activity to confirm effectiveness of the BWR Water Chemistry program in mitigating cracking in the stainless steel tubing exposed to treated water, the staff issued RAI 3.2-1, in a letter dated July 15, 2008, asking the applicant to provide a technical justification that confirmation of BWR Water Chemistry Program effectiveness is not needed for these components, and to justify the use of generic note A for these AMR results.

In its response to RAI 3.2-1 dated August 15, 2008, the applicant provided the following response:

> For the AMR results listed in LRA Tables 3.2.2-2 and 3.2.2-4 for stainless steel tubing in a treated water environment and with an aging effect of cracking, verification of the effectiveness of the BWR Water Chemistry Program is needed. The Chemistry Program Effectiveness Inspection provides confirmation of the effectiveness of the BWR Water Chemistry Program in managing the effects of aging, including cracking of susceptible materials. Also, as discussed below, the use of note A is not appropriate.
>
> These AMR results are compared to GALL Report, item V.D2-29, for which the AMP is identified as GALL AMP XI.M7, "BWR Stress Corrosion Cracking," and GALL AMP XI.M2, "Water Chemistry." As described in plant-specific note 0207, the BWR Stress Corrosion Cracking program is applicable only to stainless steel piping (≥4 inch), pump casings, valve bodies, and reactor vessel attachments containing reactor coolant at >200°F. Therefore, the BWR Stress Corrosion Cracking program is not credited with managing cracking of stainless steel tubing exposed to treated water in the RCIC and HPCI systems. Instead, the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection are credited, and note E is used instead of note A.
>
> LRA Tables 3.2.1, 3.2.2-2, and 3.2.2-4, and the plant-specific note 0207 for the tables in LRA Section 3.2 are revised to reflect these results.

The staff reviewed the applicant's response and the associated LRA changes. The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provided mitigation for the aging effect of cracking due to SCC and IGSCC. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and includes methodology that is capable of detecting cracking due to SCC and IGSCC, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection for cracking due to SCC or IGSCC, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking due to SCC or IGSCC in stainless steel tubing exposed to treated water >60°C (>140°F) in the RCIC system and in the HPCI system to be acceptable. On this basis, the staff finds that the issue raised in RAI 3.2-1 is resolved by the applicant's changes in the LRA.

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

LRA Table 3.2.2-1 addresses carbon steel RHR heat exchanger shells, shell covers and tube sheets in a treated water environment. The applicant specified use of the BWR Water Chemistry Program, alone, for managing the aging effect of loss of material due to general, pitting, crevice, and galvanic corrosion. For these AMR results the applicant referred to LRA Table 3.2.1, Item 3.2.1-27, and cited generic Note E, indicating that the result is consistent with the corresponding GALL Report item for material, environment and aging effect, but a different AMP is credited. The staff noted that for the corresponding line in SRP-LR Table 3.2-1 and in GALL Report, Volume 1, Table 2, the recommended AMP is GALL AMP XI.M21, "Closed-Cycle

Cooling Water System," which includes both preventive measures, such as control of water chemistry to minimize corrosion and SSC, and testing and inspection to monitor the effect of corrosion and SSC on the intended function of the components.

LRA Table 3.2.2-2 addresses stainless steel reactor core isolation cooling (RCIC) turbine lube oil cooler tubes, tube sheets and channels in a treated water environment. The applicant specified use of the BWR Water Chemistry Program, alone, for managing the aging effect of loss of material due to pitting, and crevice corrosion. For these AMR results the applicant referred to LRA Table 3.2.1, Item 3.2.1-28, and cited generic Note E, indicating that the result is consistent with the corresponding GALL Report item for material, environment and aging effect, but a different AMP is credited. The staff noted that for the corresponding line in SRP-LR Table 3.2-1 and in GALL Report, Volume 1, Table 2, the recommended AMP is GALL AMP XI.M21, "Closed-Cycle Cooling Water System," which includes both preventive measures, such as control of water chemistry to minimize corrosion and SSC, and testing and inspection to monitor the effect of corrosion and SSC on the intended function of the components.

LRA Tables 3.2.2-1, 3.2.2-2, 3.2.2-3 and 3.2.2-4 address copper alloy piping and piping components and heat exchanger tubes in the RHR system, turbine lube oil heat exchanger tubes, tube sheets and channels in the RCIC system, piping and piping components in the core spray system, and lube oil heat exchanger tubes, tube sheets and channels in the HPCI system; all of these components are in a treated water environment. The applicant specified use of the BWR Water Chemistry Program, alone, for managing the aging effect of loss of material due to pitting, crevice and galvanic corrosion. For these AMR result lines, the applicant referred to LRA Table 3.2.1, item 3.2.1-29 and cited generic Note E, indicating that the result is consistent with the corresponding GALL Report item for material, environment and aging effect, but a different AMP is credited. The staff noted that for the corresponding line in SRP-LR Table 3.2-1 and in GALL Report, Volume 1, Table 2, the recommended AMP is GALL AMP XI.M21, "Closed-Cycle Cooling Water System," which includes both preventive measures, such as control of water chemistry, to minimize corrosion and SSC, and testing and inspection to monitor the effect of corrosion and SSC on the intended function of the components.

For the AMR results described in the preceding paragraphs, because the applicant proposed use of the BWR Water Chemistry Program, alone, and no inspection activity was credited to monitor effectiveness of the water chemistry program, the staff issued RAI 3.2-2, in a letter dated July 15, 2008, addressing these AMR results and asking the applicant to justify why an inspection is not performed to verify the effectiveness of the water chemistry program and confirm that loss of material is not occurring in these components.

In a letter dated August 15, 2008, the applicant responded to RAI 3.2-2 by providing the following response:

> For the AMR results listed in LRA Tables 3.2.2-1, 3.2.2-2, 3.2.2-3 and 3.2.2-4 that reference the LRA Table 1 items 3.2.1-27, 3.2.1-28 or 3.2.1-29, verification of the effectiveness of the BWR Water Chemistry Program is needed. The Chemistry Program Effectiveness Inspection will provide confirmation of the effectiveness of the BWR Water Chemistry Program in managing the effects of aging, including loss of material.
>
> LRA Tables 3.2.1, 3.2.2-1, 3.2.2-2, 3.2.2-3, and 3.2.2-4 are revised to reflect these results.

The staff reviewed the applicant's response and the associated LRA changes. The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to general, pitting, crevice, and galvanic corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to general, pitting, crevice, and galvanic corrosion, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection for loss of material due to general, pitting, crevice, and galvanic corrosion, the staff finds the applicant's LRA changes and the applicant's proposed AMPs for managing the aging effect of aging effect of loss of material due to general, pitting, crevice, and galvanic corrosion in steel, stainless steel, and copper alloy components exposed to closed-cycle cooling water in the RHR system, the reactor core isolation cooling system, the core spray system, and the high pressure coolant injection system to be acceptable. On this basis, the staff finds that the issue raised in RAI 3.2-2 is resolved by the applicant's changes in the LRA.

SER Section 3.2.2.1 Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent OE and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

In LRA Section 3.2.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the engineered safety features components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to cladding
- loss of material due to pitting and crevice corrosion
- reduction of heat transfer due to fouling
- hardening and loss of strength due to elastomer degradation
- loss of material due to erosion
- loss of material due to general corrosion and fouling
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and MIC
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations

against the criteria contained in SRP-LR Section 3.2.2.2. The staff's review of the applicant's further evaluation follows.

3.2.2.2.1 Cumulative Fatigue Damage

LRA Section 3.2.2.2.1 states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.2.2.2.2 Loss of Material Due to Cladding Breach

The staff reviewed LRA Section 3.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.

LRA Section 3.2.2.2.2 addresses loss of material and cladding breach. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.2.2.2.2 states that loss of material due to cladding breach may occur in PWR steel pump casings with stainless steel cladding exposed to treated borated water.

The staff confirmed in SRP-LR Table 3.2-1, Item 2, is only applicable to PWR plants.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.2.2.2.2 does not apply to SSES.

Based on the above, the staff concludes SRP-LR Section 3.2.2.2.2 criteria are not applicable.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.3 against the following criteria in SRP-LR Section 3.2.2.2.3:

(1) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in containment isolation piping, piping components, and piping elements at locations with stagnant flow conditions. The applicant stated that containment isolation piping and components were grouped with similar piping having the same material, environment, aging effects, and aging management program(s). As stated in Table 3.2.1, the SSES components matching the description of LRA item number 3.2.1-03 were included in the evaluation of components for LRA item number 3.2.1-05. Refer to Section 3.2.2.2.3.3 for the details of the evaluation of aging management for these components.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur on internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water. The existing AMP monitors and controls water chemistry to mitigate degradation. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is

occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

Because the grouped components have identical material, environment, aging effect and aging management program(s) recommended in the GALL Report, the staff finds the applicant's grouping of components from LRA Table 3.2.1, item 3.2.1-3, with components in LRA Table 3.2.1, item 3.2.1-5, for the purpose of AMR evaluation to be acceptable. On this basis, the staff finds it acceptable for the applicant to designate LRA Table 3.2.1, item 3.2.1-3 as not applicable.

(2) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in piping, piping components, and piping elements exposed to soil. The applicant stated that this aging effect is not applicable because there are no stainless steel piping, piping components, or piping elements exposed to soil in the ESF systems for SSES.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

LRA Table 3.2.1 states that there are no SSES components comparable to LRA item number 3.2.1-04. The applicant stated that there is no buried stainless steel piping or piping components in the ESF Systems and the staff verified the applicant's statement by a review of plant boundary drawings. The staff reviewed LRA Section 2.3.2 and verified that SSES does not have ESF systems with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from stainless steel exposed to soil. The applicant stated that no further evaluation is necessary and the staff agrees with that because there is no buried stainless steel piping or piping components in the ESF Systems.

Based on the staff's review as described above and of LRA Section 3.2 and found that there were no stainless steel piping, piping components and piping elements exposed to soil. On the basis of this review, the staff finds that SRP-LR Section 3.2.2.2.3.2 is not applicable to SSES.

(3) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in BWR piping, piping components, and piping elements exposed to treated water. The applicant stated that loss of material due to pitting and crevice corrosion for stainless steel piping components exposed to treated water in ESF Systems is managed by the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection. There are no aluminum piping components subject to AMR in ESF Systems. The BWR Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the BWR Water Chemistry Program to manage loss of material due to pitting and crevice corrosion through examination of stainless steel ESF components.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur in BWR stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The existing AMP monitors and controls water chemistry for BWRs to mitigate degradation. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with

stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to general, pitting, and crevice corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to pitting and crevice corrosion, if it should occur in the selected components. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to pitting and crevice corrosion in stainless steel piping components exposed to treated water in the ESF systems to be acceptable.

(4) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in piping, piping components, and piping elements exposed to lubricating oil. The applicant stated that loss of material for stainless steel or copper alloy piping components exposed to lubricating oil is managed by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, including water. The Lubricating Oil Inspection will provide a verification of the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to crevice and pitting corrosion through examination of stainless steel or copper alloy piping components. In its letter dated July 28, 2009, the applicant revised its response to RAI 3.2.2.3-1 and the LRA Table 3.2.2-4 to state that flex connections exposed to an internal environment of lubricating oil were fabricated from stainless steel material and not synthetic rubber as stated in the LRA. The applicant further stated that stainless steel flex hoses in a lubricating oil environment will have an aging effect of loss of material and credited the Lubricated Oil Analysis and the Lubricating Oil Inspection Programs.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur in stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur

and that component intended functions will be maintained during the period of extended operation.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.1.13, respectively. The staff reviewed the applicant's Lubricating Oil Analysis Program and determined that this program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy and stainless steel piping, piping components, piping elements and stainless steel flex hoses exposed to lubricating oil. The staff verified that the applicant has credited its Lubricating Oil Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program to manage this aging effect for ECCS system. The applicant's AMPS are consistent with those recommended for aging management in SRP-LR Section 3.2.2.2.3, Item #4 and in GALL AMR Items V.D1-24 and V.D2-22.

(5) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in partially encased tanks exposed to raw water. The applicant stated that this aging effect is not applicable because there are no outdoor stainless steel tanks in the ESF systems for SSES.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded.

The staff reviewed the applicant's Updated Final Safety Analysis Report (UFSAR) Rev.63 updated in September 2007, to determine the tanks that are relied upon as part of the ESF Systems. Based on the staff's review, the Condensate Storage Tanks are the primary source of water and then transferred to the suppression pool for the ESF Systems. The staff noted from its review that the condensate storage tanks for both Unit 1 and 2 are located outdoors but are not made of stainless steel. The staff verified that both tanks are made of carbon steel.

Based on the staff's review of the applicant's UFSAR, the staff agrees with the applicant's determination that item 5 of SRP-LR Section 3.2.2.2.3 does not apply to SSES ESF systems because there are no stainless steel tanks located outdoors that are relied upon by the ESF systems.

(6) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in piping, piping components, piping elements, and tanks exposed to internal condensation. The applicant stated that this aging effect is not applicable because there are no stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation in the ESF systems for SSES.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The GALL Report recommends further

evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.2.2.2.3.6 invokes AMR Item 8 in Table 2 of the GALL Report, Volume 1, and AMR Items V.D-2 in the GALL Report, Volume 2, as applicable to stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation in BWR emergency core cooling systems.

The staff reviewed the LRA Table 2s AMR Results for ESF systems and noted that there are no stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation in the ESF systems for SSES. Therefore, the staff concludes that this item is not applicable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3 criteria. For those line items that apply to LRA Section 3.2.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.2.2.2.4 against the following criteria in SRP-LR Section 3.2.2.2.4:

(1) LRA Section 3.2.2.2.4 addresses reduction of heat transfer due to fouling in heat exchanger tubes exposed to lubricating oil. The applicant stated that For those heat exchangers within the scope of GL 89-13 for SSES, the Piping Corrosion Program is credited with managing fouling of heat exchanger tubes exposed to lubricating oil. For heat exchangers not within the scope of GL 89-13, the Lubricating Oil Analysis Program will manage reduction in heat transfer of heat exchanger tubes exposed to lubricating oil.

SRP-LR Section 3.2.2.2.4 states that reduction of heat transfer due to fouling may occur in steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing AMP monitors and controls lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil chemistry may not always be fully effective in precluding fouling; therefore, the effectiveness of lube oil chemistry control should be verified to ensure that fouling does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control. A one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The Piping Corrosion Program is credited for RHR system motor oil cooler tubes in Table 3.2.2-1. The corresponding GALL Report Volume 2 line item is V.D2-11. For this line item, the GALL Report recommends GALL AMP XI.M39, "Lubricating Oil Analysis", and an effectiveness verification program such as one-time inspection.

Although the external surface of the motor oil cooler tubes is lubricating oil, the internal environment is raw water and this cooler is part of the GL 89-13 program. Therefore, the applicant credits the Piping Corrosion Program. The staff noted that the Piping Corrosion Program is a combination of condition monitoring program (consisting of inspections, surveillances, and testing to detect the presence of, and to assess the extent of, fouling and loss of material) and a mitigation program (consisting of chemical treatments and cleaning activities to minimize fouling and loss of material). The staff's evaluation of the Piping Corrosion program is documented in SER Section 3.0.3.2.6. Because the Piping Corrosion Program includes both the chemistry treatment and cleaning for mitigation and inspection for verification, the staff finds that the Piping Corrosion Program will adequately manage the aging effects of reduction of heat transfer through the period of extended operation.

The Lubricating Oil Analysis Program and Lubricating Oil Inspection Program is credited for RCIC turbine lube oil cooler tubes in Table 3.2.2-2, lube oil cooler tubers in Table 3.2.2-4 and heat exchanger tubes in Table 3.3.2-9. The corresponding GALL Report Volume 2 line item is V.D2-11. For these line items, the GALL Report recommends GALL AMP XI.M39, "Lubricating Oil Analysis", and an effectiveness verification program such as one-time inspection.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.1.13, respectively. The staff reviewed the applicant's Lubricating Oil Analysis Program and determined that this program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage reduction in heat transfer due to fouling in copper alloy and stainless steel heat exchanger tubes exposed to lubricating oil. The staff verified that the applicant has credited its Lubricating Oil Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program to manage this aging effect. The applicant's AMPs are consistent with those recommended for aging management in SRP-LR Section 3.2.2.2.4, Item #1 and in GALL AMR Items V.D1-9 and V.D2-11.

(2) LRA Section 3.2.2.2.4 addresses reduction of heat transfer due to fouling in heat exchanger tubes exposed to treated water. The applicant stated that the Heat Exchanger Inspection activity is a one-time inspection that will detect and characterize reduction in heat transfer of stainless steel heat exchanger tubes exposed to treated water.

SRP-LR Section 3.2.2.2.4 states that reduction of heat transfer due to fouling may occur in stainless steel heat exchanger tubes exposed to treated water. The existing program controls water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may be inadequate; therefore, the GALL Report recommends that the effectiveness of water chemistry control programs should be verified to ensure that reduction of heat transfer due to fouling does not occur. A one-time inspection is an acceptable method to ensure that reduction of heat transfer does not occur and that component intended functions will be maintained during the period of extended operation.

The LRA references this section to RCIC turbine lube oil cooler tubes in the reactor core isolation cooling system and the corresponding GALL Report Volume 2 line item is

V.D2-13. For this line item, the GALL Report recommends GALL AMP XI.M21, Closed-Cycle Cooling Water System Program. The GALL AMP XI.M21, Closed-Cycle Cooling Water System, recommends preventive measures to minimize corrosion and testing and inspection to monitor the effects of corrosion, whereas the applicant is proposing only a one-time inspection activity. The staff issued RAI 3.2.2.2.4.2-1 by letter dated July 23, 2008, requesting the applicant to justify how the one-time heat exchanger inspection activity by itself will manage the aging effect of reduction in heat transfer, without preventive measures to minimize corrosion, such as maintaining treated water chemistry control.

In its response to RAI 3.2.2.2.4.2-1 dated August 22, 2008, the applicant stated that the BWR Water Chemistry Program is credited for managing loss of material for stainless steel heat exchanger tubes exposed to treated water. The applicant also stated that since the BWR Water Chemistry Program does not contain measures for detection of aging effects through inspection, it is not credited for managing reduction in heat transfer; however, it is recognized that the same preventive actions by which the water chemistry program manages loss of material also mitigates the conditions that could result in reduction in heat transfer. The applicant further stated that due to the BWR water chemistry control, fouling of heat exchanger tubes is not expected to occur. Therefore, the applicant concluded that as stated in LRA Section B.2.24, the Heat Exchanger Inspection will provide direct evidence as to whether, and to what extent, reduction in heat transfer has occurred, or is likely to occur, that could result in a loss of intended function.

The staff confirmed that in LRA Table 3.2.2-2, BWR Water Chemistry Program is credited for managing loss of material of RCIC turbine oil coolers. For these same coolers, the applicant has credited the Heat Exchanger Inspection Program for reduction of heat transfer. The staff's evaluation of the Heat Exchanger Program is documented in SER Section 3.0.3.1.12. The Heat Exchanger Inspection Program uses visual (VT-3 or equivalent) or remote visual inspection techniques to verify the absence of, or to identify the extent of fouling on the tube surfaces. On the basis that water chemistry is maintained to minimize corrosion and fouling, the staff finds the use of the Heat Exchanger Inspection Program acceptable for managing the aging effects of reduction of heat transfer for stainless steel heat exchanger tubes exposed to treated water and finds the applicant response acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4 criteria. For those line items that apply to LRA Section 3.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The staff reviewed LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5.

LRA Section 3.2.2.2.5 addresses hardening and loss of strength due to elastomer degradation. The applicant stated that the System Walkdown Program is credited with managing

degradation due to aging of the visible external surfaces, and in some cases the internal surfaces, of these components.

SRP-LR Section 3.2.2.2.5 states that hardening and loss of strength due to elastomer degradation may occur in elastomer seals and components of the BWR standby gas treatment system ductwork and filters exposed to air - indoor uncontrolled. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

SRP-LR Section 3.2.2.2.5 invokes AMR Item 11 in Table 2 of the GALL Report, Volume 1, and AMR Items V.B-4 in the GALL Report, Volume 2, as applicable to elastomeric seals and components in SGTS. In these AMRs, the staff identifies that hardening and loss of strength due to elastomer degradation may occur in elastomeric seal or component surfaces that are exposed either internally or externally to uncontrolled indoor air. In these AMRs, the GALL Report recommends that a plant-specific aging management program is to be evaluated and credited to manage hardening and loss of strength in the elastomer seal surfaces that are exposed either internally or externally to indoor air.

The staff noted that in the applicant's AMR for these components, as given in LRA Table 3.2.2-7, the applicant identified that the flexible connections in the SGTS ductwork are the applicable SGTS components falling within the scope of this assessment and that neoprene is the applicable elastomeric material (rubber). The applicant also identified that the neoprene flexible connections are exposed internally to a ventilation environment and externally to uncontrolled indoor air. The applicant stated that is crediting its Systems Walkdown Program to manage hardening and loss of strength in these materials.

The staff noted that, in AMP B.2.32, the applicant stated that the purpose of the System Walkdown Program is, in part, to manage cracking and/or change in material properties for elastomers (neoprene and rubber) and polymers (Teflon) that are exposed to indoor air or ventilation environments. The staff noted the GALL AMP XI.M36, "External Surfaces Monitoring," is the program in the GALL Report that corresponds to the applicant's System Walkdown Program. The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of this AMP is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," does not apply to elastomeric components or to the management of hardening or loss of strength in elastomeric components. Thus, the staff had several issues with the applicant's AMR for the SGTS neoprene flexible connections and with crediting the Systems Walkdown Program to manage hardening and loss of strength in these elastomeric components.

With respect to the first issue taken on the applicant's AMR, the staff noted that in the applicant's AMRs on management of changes in material properties for the neoprene flexible SGTS connections, the applicant credited its Systems Walkdown Program with aging management of both the internal surfaces that are exposed to the ventilation environment and the external surfaces that are exposed to the uncontrolled indoor air environment. In contrast, the staff noted that scope of GALL AMP XI.M36, "External Surfaces Monitoring," does not include elastomeric components nor does it apply to the management of changes in material properties (such as hardening and loss of strength) that may occur in elastomeric components.

The staff also noted the "scope of program" program element in GALL AMP XI.M36, "External Surfaces Monitoring," states that programs corresponding to GALL AMP XI.M36 may only be applied to internal surfaces if the "material and environment combinations are the same for internal and external surfaces such that external surface condition is representative of internal surface condition, and that when credited for internal surfaces, "the program should describe the component internal environment and the credited similar external component environment inspected." In RAI B.2.32-4 by letter dated July 23, 2008, the staff asked the applicant to justify its basis for crediting the System Walkdown Program to manage cracking and changes in material properties that may occur in the external surfaces of in-scope components that are fabricated from either an elastomeric or polymeric material. The staff also asked the applicant to clarify how a visual examination alone from the external surfaces of these materials would be capable of detecting the following aging effects: (1) a tightly configured crack that penetrates the external surface of the component, (2) a subsurface crack or a crack that only penetrates the internal surface of the materials, and (3) a change in a material property, such as a potential change in the hardness property or strength property for the elastomer or polymer material used to fabricate the component. RAI B.2.32-4 is relevant to the acceptance of the applicant's internal and external surface AMRs for the neoprene flexible SGTS connections. The applicant's RAI B2.32-4 response is evaluated and accepted by the staff and documented in SER Section 3.0.3.2.14.

With respect to the second issue taken on the applicant's AMR, the staff noted that in AMP B.2.32, System Walkdown Program, the applicant credits the program, in part, for aging management of both cracking and changes in material properties for elastomer (i.e., neoprene or rubber) and plastic (polymer) components that are exposed to uncontrolled indoor air or ventilation environments. The staff noted, however, that in LRA Table 3.2.2-7, the applicant did not provide either a plant-specific AMR or enhanced AMR aligning to GALL AMR V.B-4 that identified cracking as an applicable aging effect requiring management for the flexible neoprene SGTS connections that are exposed internally to the ventilation environment or externally to the uncontrolled indoor air environment. In RAI #3.2.2.2.5-1 by letter dated July 23, 2008, the staff asked the applicant to justify why LRA Table 3.2.2-7 did not include any AMRs on cracking of the neoprene flexible SGTS connections that are exposed internally to the ventilation environment or externally to the uncontrolled indoor air environment, when LRA AMP B.2.32 implies that cracking could occur in these neoprene components. Alternatively, if cracking is an applicable aging effect requiring management for the internal and external surfaces of these flexible SGTS connections, the staff requested the applicant in the RAI to amend the LRA to include AMR's that identify cracking as an AERM for the internal and external surfaces of the components, and to clarify which AMP or AMPs would be credited with the management of cracking in the neoprene flexible SGTS connection surfaces that are exposed to uncontrolled indoor air and to the ventilation environment.

In its response to RAI 3.2.2.2.5-1 dated August 27, 2008, the applicant stated that in Table 3.2.2-7, cracking was inadvertently omitted from the "Aging Effect Requiring Management" column. The applicant amended the LRA to revise Table 3.2.2-7 to add the aging effect of cracking for neoprene flexible connections in an internal environment of ventilation and an external environment of indoor air, and credited the System Walkdown Program to manage this aging effect. The applicant also revised LRA Section 3.2.2.2.5 to state that because the relevant conditions for aging that exist in the internal environment are essentially the same as those that exist in the external environment, the System Walkdown Program is also credited with managing degradation due to aging of the internal surfaces.

The staff finds the response acceptable because the applicant added the aging effect of cracking for neoprene flexible connections and explained why the System Walkdown Program, which is for inspection of external surfaces, is also credited for managing degradation of internal surfaces of the flexible connections. The staff's review of the System Walkdown Program is documented in SER Section 3.0.3.2.14.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.5 criteria. For those line items that apply to LRA Section 3.2.2.2.5, the staff determines that the LRA, as amended in response to associated RAIs is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.6 Loss of Material Due to Erosion

The staff reviewed LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6.

LRA Section 3.2.2.2.6 addresses loss of material due to erosion. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.2.2.2.6 states that loss of material due to erosion may occur in the stainless steel high-pressure safety injection (HPSI) pump miniflow recirculation orifice exposed to treated borated water.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.2.2.2.6 does not apply to SSES.

Based on the above, the staff concludes SRP-LR Section 3.2.2.2.6 criteria are not applicable.

3.2.2.2.7 Loss of Material Due to General Corrosion and Fouling

The staff reviewed LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7.

LRA Section 3.2.2.2.7 addresses loss of material due to general corrosion and fouling. The applicant stated that this aging effect is not applicable because SSES nozzles used for containment spray are formed of stainless steel. Stainless steel flow elements are used in place of flow orifices.

SRP-LR Section 3.2.2.2.7 states that loss of material due to general corrosion and fouling may occur on steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled and may cause plugging of the spray nozzles and flow orifices. This aging mechanism and effect will apply since the spray nozzles and flow orifices are occasionally wetted even though this system is mostly on standby. The wetting and drying of these components can accelerate corrosion and fouling. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.2.2.2.7 invokes AMR Item 13 in Table 2 of the GALL Report, Volume 1, and AMR Items V.D-1 in the GALL Report, Volume 2, as applicable to steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled in BWR emergency core cooling systems.

The staff finds this item is not applicable because SSES nozzles and flow elements used for containment spray are made of stainless steel, which has no aging effects requiring management in an air-indoor uncontrolled environment as identified by the GALL Report Item V.F-12.

Based on the above, the staff concludes SRP-LR Section 3.2.2.2.7 criteria are not applicable.

3.2.2.2.8 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.8 against the following criteria in SRP-LR Section 3.2.2.2.8:

(1) LRA Section 3.2.2.2.8 addresses loss of material due to general, pitting, and crevice corrosion in BWR piping, piping components, and piping elements. The applicant stated that loss of material due to general, pitting, and crevice corrosion for steel piping components exposed to treated water is managed by the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection. The BWR Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the BWR Water Chemistry Program to manage loss of material due to general, pitting, and crevice corrosion through examination of steel piping components.

SRP-LR Section 3.2.2.2.8 states that loss of material due to general, pitting, and crevice corrosion may occur in BWR steel piping, piping components, and piping elements exposed to treated water. The existing AMP monitors and controls water chemistry for BWRs to mitigate degradation. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to general, pitting and crevice corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to general, pitting or crevice corrosion, if it should occur in the selected components. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to general, pitting or crevice corrosion in steel piping, piping components and piping elements exposed to treated water in the ESF systems to be acceptable.

(2) LRA Section 3.2.2.2.8 addresses loss of material due to general, pitting, and crevice corrosion in piping, piping components, and piping elements exposed to treated water. The applicant stated that containment isolation piping and components are grouped with similar piping having the same material, environment, aging effects, and aging management program(s). As stated in Table 3.2.1, the SSES components matching the description of LRA item number 3.2.1-15 are included in the evaluation of components for LRA item number 3.2.1-14. Refer to Section 3.2.2.2.8.1 for the details of the evaluation of aging management for these components.

SRP-LR Section 3.2.2.2.8 states that loss of material due to general, pitting, and crevice corrosion may occur on the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. The existing AMP monitors and controls water chemistry to mitigate degradation. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

Because the grouped components have identical material, environment, aging effect and aging management program(s) recommended in the GALL Report, the staff finds the applicant's grouping of components from LRA Table 3.2.1, item 3.2.1-15, with components in LRA Table 3.2.1, item 3.2.1-14, for the purpose of AMR evaluation to be acceptable. On this basis, the staff finds it acceptable for the applicant to designate LRA Table 3.2.1, item 3.2.1 15 as not applicable.

(3) LRA Section 3.2.2.2.8 addresses loss of material due to general, pitting, and crevice corrosion in piping, piping components, and piping elements exposed to lubricating oil. The applicant stated that loss of material for steel piping components exposed to lubricating oil is managed by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, including water. The Lubricating Oil Inspection will provide a verification of the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion through examination of steel piping components.

SRP-LR Section 3.2.2.2.8 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements exposed to lubricating oil. The existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation to verify the effectiveness of lubricating oil programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.1.13 respectively. The staff reviewed the applicant's Lubricating Oil Analysis Program and determined that this program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to general, pitting and crevice, corrosion in steel piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its Lubricating Oil Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program to manage this aging effect for ECCS system. The applicant's AMPS are consistent with those recommended for aging management in SRP-LR Section 3.2.2.2.8, Item #3 and in GALL AMR Item V.D2-30.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8 criteria. For those line items that apply to LRA Section 3.2.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

The staff reviewed LRA Section 3.2.2.2.9 against the criteria in SRP-LR Section 3.2.2.2.9.

LRA Section 3.2.2.2.9 addresses loss of material due to general, pitting, crevice, and MIC. The applicant stated that this aging effect is not applicable because there are no steel piping, piping components, or piping elements exposed to soil in the ESF systems for SSES.

SRP-LR Section 3.2.2.2.9 states that loss of material due to general, pitting, crevice, and MIC may occur in steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. Buried piping and tanks inspection programs rely on industry practice, frequency of pipe excavation, and OE to manage the aging effects of loss of material from general, pitting, and crevice corrosion, and MIC. The effectiveness of the buried piping and tanks inspection program should be verified by evaluation of an applicant's inspection frequency and OE with buried components to ensure that loss of material does not occur.

The staff reviewed the UFSAR for SSES and verified that the SSES design does not include any ESF components that are buried or are exposed to soil. Based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding that the staff's guidance in SRP-LR Section 3.2.2.2.9, and the AMR items in GALL referenced by this SRP-LR section, are not applicable for SSES because the ESF design does not include any components that are exposed to a soil environment or that are buried.

Based on the above, the staff concludes SRP-LR Section 3.2.2.2.9 criteria is not applicable.

3.2.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.2.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-7, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.2.2-1 through 3.2.2-7, the applicant indicated, via notes F through J that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.2.2.3.1 Aging Management Review Results - Residual Heat Removal System – LRA Table 3.2.2-1

The staff reviewed LRA Table 3.2.2-1, which summarizes the results of AMR evaluations for the RHR system component groups.

In LRA Table 3.2.2-1, the applicant proposed to manage loss of material in copper alloy heat exchanger tubes and tube sheets in an internal environment of raw water by using the Piping Corrosion Program. The applicant referenced footnote G for this line item indicating that environment is not in the GALL Report for this component. However, the staff noted that GALL Report Item VII.C1-3 has the same component, material, environment and aging effect combination and recommends GALL AMP XI.M20, Open-Cycle Cooling Water System. The applicant's Piping Corrosion Program is consistent with GALL AMP XI.M20. The staff's evaluation of the Piping Corrosion Program is documented in SER Section 3.0.3.2.6. On the basis that this line item is consistent with GALL Report line item VII.C1-3, the staff finds that the Piping Corrosion Program will adequately manage the aging effect of loss of material in copper alloy heat exchanger tubes and tube sheets in an internal environment of raw water through the period of extended operation.

In LRA Table 3.2.2-1, the applicant proposed to manage reduction of heat transfer in copper alloy heat exchanger tubes in an internal environment of raw water by using the Piping Corrosion Program. The applicant referenced footnote G for this line item indicating that environment is not in the GALL Report for this component. However, the staff noted that GALL Report Item VII.C1-6 has the same component, material, environment and aging effect combination and recommends GALL AMP XI.M20, Open-Cycle Cooling Water System. The applicant's Piping Corrosion Program is consistent with GALL AMP XI.M20. The staff's

evaluation of the Piping Corrosion Program is documented in SER Section 3.0.3.2.6. On the basis that this line item is consistent with GALL Report line item VII.C1-6, the staff finds that the Piping Corrosion Program will adequately manage the aging effect of reduction of heat transfer in copper alloy heat exchanger tubes in an internal environment of raw water through the period of extended operation.

In LRA Table 3.2.2-1, the applicant proposed to manage loss of material in nickel based alloy heat exchanger tube plugs in an internal environment of raw water by using the Piping Corrosion Program. The applicant referenced footnote G for this line item indicating that environment is not in the GALL Report for this component. The staff noted that nickel based alloy is not included in the GALL Report, however, it is a similar material to the copper alloy material identified in GALL Report Item VII.C-3 for the same component, environment and aging effect combination. The GALL Report recommends AMP XI.M20, Open-Cycle Cooling Water System, for item VII.C3. The applicant's Piping Corrosion Program is consistent with GALL AMP XI.M20. The staff's evaluation of the Piping Corrosion Program is documented in SER Section 3.0.3.2.6. On the basis that line item in Table 3.2.2-1 is similar to the GALL Report Item VII.C-3, the staff finds that the Piping Corrosion Program will adequately manage the aging effect of loss of material in nickel based alloy heat exchanger tube plugs in an internal environment of raw water through the period of extended operation.

In LRA Table 3.2.2-1, the applicant proposed to manage loss of material of carbon steel piping in an external environment of indoor air by using the Supplementary Piping/Tank Inspection Program. The applicant referenced footnote "H" for this line item indicating that aging effect is not in NUREG-1801 for this component, material and environment combination. The applicant also referenced footnote 0203 indicating that this is in an aggressive air/water interface environment.The definition of footnote "H" implies that these line items are not consistent with GALL Report. However, the LRA has also referenced GALL Report Item V.D2-2 and Table 3.2.1, line item 3.2.1-31. The staff issued RAI 3.2.2.3.1-1 in a letter dated July 23, 2008, to request the applicant to justify why a GALL Report and Table 1 item is identified if the line item is not consistent with the GALL Report.

In its letter dated August 22, 2008, in response to RAI 3.2.2.3.1-1, the applicant responded that the Note H was used incorrectly in LRA Table 3.2.2-1; instead, Note E should have been used. The applicant also stated that this is consistent with the use of Note E for a similar component, material and environment combination in Table 3.2.2-2. The applicant revised the LRA Table 3.2.2-1 to change the note from Note H to Note E. The evaluation of this line item is documented in SER Section 3.2.2.1.3.

In LRA Tables 3.2.2-1 the applicant proposed to manage cracking in copper alloy piping and piping components in an environment of treated water by using the BWR Water Chemistry Program, alone. The applicant cited generic Note H for these AMR results, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. In a letter dated July 15, 2008, the staff issued RAI 3.2-3, applicable for these AMR results and for similar AMR results in LRA Tables 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3. The RAI asked the applicant to provide a technical justification as to why an inspection program, such as the CPEI is not needed to confirm that the BWR Water Chemistry Program is effective in preventing the aging effect.

In a letter dated August 15, 2008, the applicant responded to RAI 3.2-3 by providing the following response:

> For the five AMR results lines listed in LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3, where the material is copper alloy, the environment is treated water (internal), and the aging effect is cracking, verification of the effectiveness of the BWR Water Chemistry Program is needed. The CPEI will provide confirmation of the effectiveness of this program in managing the effects of aging, including cracking in susceptible materials.
>
> LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3 are revised to reflect these results.

The staff reviewed the applicant's response and the associated LRA changes. The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of cracking due to stress corrosion cracking. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and uses examination techniques that are capable of detecting cracking, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection of the aging effect if it should occur, the staff finds the applicant's proposed AMPs for managing the potential aging effect of cracking due to stress corrosion cracking in copper alloy piping and piping components exposed to treated water in the RHR system to be acceptable. On this basis, the staff finds that the issue raised in RAI 3.2-3 is resolved by the applicant's LRA changes.

LRA Table 3.2.2-1 summarizes the results of AMRs for the RHR system heat exchangers tube plugs constructed from nickel based alloy which do not have an external surface in contact with an environment. Therefore, the environment, aging effect requiring management, and AMRs are not applicable. The staff agrees with this position because these components do not have an external surface in contact with an environment because their external surface is in contact with the inside of the heat exchanger tubes.

The applicant has listed a number of component, material, environment combinations as N/A. Table 3.0-1, "Internal Environments," defines N/A as "N/A internal is used for components for which an internal environment is not applicable (e.g., strainer screens, heat exchanger fins, flow elements)." Table 3.0-2, "External Environments," defines N/A external as "N/A is used for components for which an external environment is not applicable (e.g., tube plugs)."

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Aging Management Review Results - Reactor Core Isolation Cooling – LRA Table 3.2.2-2

The staff reviewed LRA Table 3.2.2-2, which summarizes the results of AMR evaluations for the reactor core isolation cooling component groups.

In LRA Table 3.2.2-2, the applicant proposed to manage cracking in copper alloy turbine lube oil cooler tubes in an internal environment of treated water by using the Heat Exchanger Inspection Program. The applicant referenced footnote H for this line item indicating that aging effect is not in NUREG-1801 for this component, material and environment combination.

The Heat Exchanger Inspection will use volumetric (RT or UT) techniques to verify the absence of, or to identify the extent of, SCC on the internal surfaces of the copper alloy (admiralty brass) tubes that are exposed to the treated water environment. The staff's evaluation of the Heat Exchanger Inspection Program is documented in SER Section 3.0.3.1.12. Because the treated water environment is less than 140oF, cracking in copper alloy components is of very low probability, and therefore, the staff finds a one-time inspection activity that performs volumetric examination to verify the absence of cracking is an adequate aging management program. On this basis, the staff finds the Heat Exchanger Inspection Program will adequately manage the aging effects of cracking in copper alloy heat exchanger tubes in an internal environment of treated water through the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.3 Aging Management Review Results - Core Spray System – LRA Table 3.2.2-3

The staff reviewed LRA Table 3.2.2-3, which summarizes the results of AMR evaluations for the core spray system component groups.

In LRA Tables 3.2.2-3 the applicant proposed to manage cracking in copper alloy piping and piping components in an environment of treated water by using the BWR Water Chemistry Program, alone. The applicant cited generic Note H for these AMR results, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. In a letter dated July 15, 2008, the staff issued RAI 3.2-3, applicable for these AMR results and for similar AMR results in LRA Tables 3.2.2-1, 3.3.2-3, 3.3.2-25, and 3.4.2-3. The RAI asked the applicant to provide a technical justification as to why an inspection program, such as the CPEI is not needed to confirm that the BWR Water Chemistry Program is effective in preventing the aging effect.

In a letter dated August 15, 2008, the applicant responded to RAI 3.2-3 by providing the following response:

> For the five AMR results lines listed in LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3, where the material is copper alloy, the environment is treated water (internal), and the aging effect is cracking, verification of the effectiveness of the BWR Water Chemistry Program is needed. The Chemistry Program Effectiveness Inspection will provide confirmation of the effectiveness

of this program in managing the effects of aging, including cracking in susceptible materials.

LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3 are revised to reflect these results.

The staff reviewed the applicant's response and the associated LRA changes. The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of cracking due to stress corrosion cracking. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and uses examination techniques that are capable of detecting cracking, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection of the aging effect if it should occur, the staff finds the applicant's proposed AMPs for managing the potential aging effect of cracking due to stress corrosion cracking in copper alloy piping and piping components exposed to treated water in the core spray system to be acceptable. On this basis, the staff finds that the issue raised in RAI 3.2-3 is resolved by the applicant's LRA changes.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.4 Aging Management Review Results - High Pressure Coolant Injection System – LRA Table 3.2.2-4

The staff reviewed LRA Table 3.2.2-4, which summarizes the results of AMR evaluations for the high pressure coolant injection system component groups.

In LRA Table 3.2.2-4, the applicant proposed to manage cracking in copper alloy turbine lube oil cooler tubes in an internal environment of treated water by using the Heat Exchanger Inspection Program. The applicant referenced footnote H for this line item indicating that aging effect is not in NUREG-1801 for this component, material and environment combination.

The Heat Exchanger Inspection will use volumetric (RT or UT) techniques to verify the absence of, or to identify the extent of, SCC on the internal surfaces of the copper alloy (admiralty brass) tubes that are exposed to the treated water environment. The staff's evaluation of the Heat Exchanger Inspection Program is documented in SER Section 3.0.3.1.12. Because the treated water environment is less than 140°F, cracking in copper alloy components is of very low probability, and therefore, the staff finds a one-time inspection activity that performs volumetric examination to verify the absence of cracking is an adequate aging management program. On this basis, the staff finds the Heat Exchanger Inspection Program will adequately manage the aging effects of cracking in copper alloy heat exchanger tubes in an internal environment of treated water through the period of extended operation.

In LRA Table 3.2.2-4, the applicant identifies that there are no applicable aging effects requiring management (AERMs) for synthetic rubber flexible connections (hoses) in the HPCI system under either internal exposure to the lubricating oil environment or external exposure to the indoor air environment.

The staff noted in the LRA, the applicant appeared to take inconsistent approach to aging management of elastomeric, rubber, polymeric, and glass components in the application because some AMRs for these types of materials the applicant had identified that cracking and changes in material properties were applicable aging effects requiring management (AERMs), whereas in other AMRs the applicant concluded that AERMs were not applicable to the components. In RAI 3.2.2.3-1 by letter dated July 23, 2008, the staff asked the applicant to consolidate its approach to management of aging in the elastomeric, rubber, polymeric, and glass ESF system components with the aging management approach that the applicant had taken for these types of components in the auxiliary systems. In RAI 3.2.2.3-1, Part A, the staff asked the applicant to justify why it had not identified any AERMs for HPCI synthetic rubber component surfaces that are exposed to lubricating oil and to indoor air when cracking and changes in materials had been identified as applicable aging effects for: (1) neoprene and rubber components in the primary containment atmosphere circulation system under exposure to indoor air and to ventilation air, (2) neoprene/fiberglass components in the reactor building HVAC system under exposure to indoor air and to ventilation air, and (3) for Teflon piping in the sampling system (changes in material properties only) under exposure to indoor air. In RAI 3.3.2.3-1, Part B, the staff asked the applicant to identify those material properties and aging effects that could be impacted by exposure of these synthetic rubber materials to the lubricating oil and indoor air environments.

In its letter dated July 28, 2009, the applicant revised Table 3.2.2-4, HPCI system to state that flex connections exposed to an internal environment of lubricating oil and an external environment of indoor air were fabricated from stainless steel material and not from synthetic rubber as stated in the LRA. The applicant further stated that stainless steel flex hoses in a lubricating oil environment will have an aging effect of loss of material and credited the Lubricated Oil Analysis and the Lubricating Oil Inspection Programs and referenced Table 3.2.1, item 3.2.1-6. This line is now consistent with GALL Report Item V.D1-24 and the evaluation of this line is addressed in SER Section 3.2.2.2.3.4.

The applicant also stated that stainless steel flex hoses in an indoor air external environment will have no aging effects and is consistent with GALL Report Item V.F-12. The staff reviewed the GALL Report and finds the applicant response acceptable. The issue identified in RAI 3.2.2.3-1 is closed.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.5 Aging Management Review Results - Containment and Suppression System – LRA Table 3.2.2-5

The staff reviewed LRA Table 3.2.2-5, which summarizes the results of AMR evaluations for the containment and suppression system component groups. The staff determined that all AMR evaluation results in LRA Table 3.2.2-5 are consistent with the GALL Report.

3.2.2.3.6 Aging Management Review Results - Containment Atmosphere Control System – LRA Table 3.2.2-6

The staff reviewed LRA Table 3.2.2-6, which summarizes the results of AMR evaluations for the containment atmosphere control system component groups. The staff determined that all AMR evaluation results in LRA Table 3.2.2-6 are consistent with the GALL Report.

3.2.2.3.7 Aging Management Review Results - Standby Gas Treatment System – LRA Table 3.2.2-7

The staff reviewed LRA Table 3.2.2-7, which summarizes the results of AMR evaluations for the SGTS component groups.

In LRA Table 3.2.2-7, the applicant proposed to manage loss of material for galvanized steel ductwork components exposed to an external environment of outdoor air using the SSES AMP B.2.32 "System Walkdown Program." The staff noted that the applicant amended its LRA by letter dated September 26, 2008, to add this AMR line item to LRA Table 3.2.2-7.

The AMR line item credits the AMP B.2.32 "System Walkdown Program" to manage loss of material for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in GALL Report for this component, environment and material combination. The staff's evaluation of the AMP B.2.32 "System Walkdown Program" is documented in SER Section 3.0.3.2.14. The staff determined that this program is a condition monitoring program that will detect the aging effect of loss of material for metals, including steel, by periodic surveillance activities and observations of components' external surfaces to detect aging degradation that are within the scope of license renewal. On the basis that the applicant will be performing periodic visual inspections of these components, the staff finds the AMR results for this line item acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the engineered safety features components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3 Aging Management of Auxiliary Systems

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

- Building Drains Nonradioactive System
- Containment Instrument Gas System

- Control Rod Drive Hydraulic System
- Control Structure Chilled Water System
- Control Structure HVAC Systems
- Cooling Tower System
- Diesel Fuel Oil System
- Diesel Generator Buildings HVAC Systems
- Diesel Generators System
- Domestic Water System
- Emergency Service Water System
- ESSW Pumphouse HVAC System
- Fire Protection System
- Fuel Pool Cooling And Cleanup System And Fuel Pool And Auxiliaries
- Neutron Monitoring System
- Primary Containment Atmosphere Circulation System
- Process And Area Radiation Monitoring System
- Radwaste Liquid System
- Radwaste Solids Handling
- Raw Water Treatment System
- Reactor Building Chilled Water System
- Reactor Building Closed Cooling Water System
- Reactor Building HVAC System
- Reactor Nonnuclear Instrumentation System
- Reactor Water Cleanup System
- RHR Service Water System
- Sampling System
- Sanitary Drainage
- Service Air System
- Service Water System
- Standby Liquid Control System
- Turbine Building Closed Cooling Water System
- Reactor Recirculation System (NSAS portions)
- Reactor Vessel and Auxiliaries System (NSAS portions)

3.3.1 Summary of Technical Information in the Application

LRA Section 3.3 provides AMR results for the auxiliary systems components and component groups. LRA Table 3.3.1, "Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the auxiliary systems components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry OE in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry OE included a review of the GALL Report and OE issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within

the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.3.2.1.
In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.3.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.3.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.3.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's OE to verify the applicant's claims.

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

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

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel cranes - structural girders exposed to air - indoor uncontrolled (external) (3.3.1-1)	Cumulative fatigue damage	TLAA to be evaluated for structural girders of cranes. See the SRP-LR, Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1).	Yes	Not applicable	Not applicable to SSES (See SER Section 3.3.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air - indoor uncontrolled, treated borated water or treated water (3.3.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	TLAA (See SER Section 3.3.2.2.1)
Stainless steel heat exchanger tubes exposed to treated water (3.3.1-3)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable. The applicant addressed these components under GALL Report Item number 3.3.1-52. (See SER Section 3.3.2.2.2)
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution > 60°C (> 140°F) (3.3.1-4)	Cracking due to SCC	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable. The normal operating temperature of the Standby Liquid Control System is below 140°F; and therefore, cracking due to SCC is not an aging effect requiring management. (See SER Section 3.3.2.2.3.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and stainless clad steel heat exchanger components exposed to treated water > 60°C (> 140°F) (3.3.1-5)	Cracking due to SCC	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable. The applicant does not have stainless steel or stainless steel clad heat exchangers exposed to treated water >60°C (>140°F) in the RWCU system. RWCU heat exchangers which are exposed to this environment are carbon steel. However, stainless steel heat exchanger components exposed to treated water >60°C (>140°F) in other auxiliary systems are evaluated in item 3.3.1-46. (See SER Section 3.3.2.2.3.2)
Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-6)	Cracking due to SCC	A plant-specific aging management program is to be evaluated.	Yes	Supplemental Piping and Tanks Inspection Program (B.2.28)	See SER Section 3.3.2.2.3.3
Stainless steel non-regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-7)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.3.2.2.4.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-8)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to SCC and cyclic loading. A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.3.2.2.4.2)
Stainless steel high-pressure pump casing in PWR chemical and volume control system (3.3.1-9)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to SCC and cyclic loading. A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.3.2.2.4.3)
High-strength steel closure bolting exposed to air with steam or water leakage. (3.3.1-10)	Cracking due to SCC, cyclic loading	Bolting Integrity. The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance.	Yes	Not applicable	Not Applicable. High strength steel bolting is not used in the auxiliary systems.
Elastomer seals and components exposed to air - indoor uncontrolled (internal/external) (3.3.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes	System Walkdown Program (B.2.32)	Consistent with GALL Report (See SER Section 3.3.2.2.5.1)
Elastomer lining exposed to treated water or treated borated water (3.3.1-12)	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes	Not Applicable	See SER Section 3.3.2.2.5.2

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water (3.3.1-13)	Reduction of neutron-absorbing capacity and loss of material due to general corrosion	A plant-specific aging management program is to be evaluated.	Yes	BWR Water Chemistry Program (B.2.2)	Consistent with the GALL Report (See SER Section 3.3.2.2.6)
Steel piping, piping component, and piping elements exposed to lubricating oil (3.3.1-14)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program (B.2.33) and Lubricating Oil Inspection Program (B.2.25)	Consistent with GALL Report (See SER Section 3.3.2.2.7.1)
Steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil (3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable (See SER Section 3.3.2.2.7.1)
Steel reactor coolant pump oil collection system tank exposed to lubricating oil (3.3.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank	Yes	Not applicable	Not applicable (See SER Section 3.3.2.2.7.1)
Steel piping, piping components, and piping elements exposed to treated water (3.3.1-17)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.2.7.2)
Stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-18)	Loss of material/general (steel only), pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	System Walkdown Program (B.2.32)	See SER Section 3.3.2.2.7.3

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil (3.3.1-19)	Loss of material due to general, pitting, crevice, and MIC	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Buried Piping and Tanks Surveillance (B.2.18) and Buried Piping and Tanks Inspection (B.2.30)	Consistent with GALL Report (See SER Section 3.3.2.2.8)
Steel piping, piping components, piping elements, and tanks exposed to fuel oil (3.3.1-20)	Loss of material due to general, pitting, crevice, and MIC, and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry Program (B.2.20) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.2.9.1)
Steel heat exchanger components exposed to lubricating oil (3.3.1-21)	Loss of material due to general, pitting, crevice, and MIC, and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis (B.2.33) and Lubricating Oil Inspection (B.2.25)	Consistent with GALL Report (See SER Section 3.3.2.2.9.2)
Steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water and treated borated water (3.3.1-22)	Loss of material due to pitting and crevice corrosion (only for steel after lining/cladding degradation)	Water Chemistry and One-Time Inspection	Yes	Not Applicable	See SER Section 3.3.2.2.10.1
Stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water (3.3.1-23)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Closed Cooling Water Chemistry Program (B.2.14) and Chemistry Program Effectiveness Inspection (B.2.22) Closed Cooling Water Chemistry Program (B.2.14)	Consistent with GALL Report (See SER Section 3.3.2.2.10.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.3.1-24)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2), and Chemistry Program Effectiveness Inspection (B.2.22), or BWR Water Chemistry Program (B.2.2), or Closed Cooling Water Chemistry Program (B.2.14) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.2.10.2)
Copper alloy HVAC piping, piping components, piping elements exposed to condensation (external) (3.3.1-25)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	System Walkdown (B.2.32), Cooling Units Inspection (B.2.23), and Selective Leaching Inspection (B.2.29)	Consistent with GALL Report (See SER Section 3.3.2.2.10.3)
Copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.3.1-26)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program (B.2.33) and Lubricating Oil Inspection Program (B.2.25)	Consistent with GALL Report (See SER Section 3.3.2.2.10.4)
Stainless steel HVAC ducting and aluminum HVAC piping, piping components and piping elements exposed to condensation (3.3.1-27)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	System Walkdown (B.2.32), Cooling Units Inspection (B.2.23), and Supplemental Piping/Tank Inspection (B.2.28)	Consistent with the GALL Report (See SER Section 3.3.2.2.10.5)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy fire protection piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-28)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Not Applicable	See SER Section 3.3.2.2.10.6
Stainless steel piping, piping components, and piping elements exposed to soil (3.3.1-29)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	See SER Section 3.3.2.2.10.7
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution (3.3.1-30)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.2.10.8)
Copper alloy piping, piping components, and piping elements exposed to treated water (3.3.1-31)	Loss of material due to pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.2.11)
Stainless steel, aluminum and copper alloy piping, piping components, and piping elements exposed to fuel oil (3.3.1-32)	Loss of material due to pitting, crevice, and MIC	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry Program (B.2.20) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with the GALL Report (See SER Section 3.3.2.2.12.1)
Stainless steel piping, piping components, and piping elements exposed to lubricating oil (3.3.1-33)	Loss of material due to pitting, crevice, and MIC	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program (B.2.33) and Lubricating Oil Inspection Program (B.2.25)	Consistent with GALL Report (See SER Section 3.3.2.2.12.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Elastomer seals and components exposed to air - indoor uncontrolled (internal or external) (3.3.1-34)	Loss of material due to wear	A plant-specific aging management program is to be evaluated.	Yes	Not Applicable	See SER Section 3.3.2.2.13
Steel with stainless steel cladding pump casing exposed to treated borated water (3.3.1-35)	Loss of material due to cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC IN 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.3.2.2.14)
Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water (3.3.1-36)	Reduction of neutron-absorbing capacity due to boraflex degradation	Boraflex Monitoring	No	Not applicable	Not applicable to SSES (See SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-37)	Cracking due to SCC, IGSCC	BWR Reactor Water Cleanup System	No	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.2)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-38)	Cracking due to SCC	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Addressed in line item 3.3.1-37.

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel BWR spent fuel storage racks exposed to treated water > 60°C (> 140°F) (3.3.1-39)	Cracking due to SCC	Water Chemistry	No	Not applicable	Not applicable because spent fuel pool water temperature is maintained well below 60°C (<140°F). This component, material, environment combination does not exist, and the aging effect identified in the GALL Report does not apply.(See SER Section 3.3.2.1.1)
Steel tanks in diesel fuel oil system exposed to air - outdoor (external) (3.3.1-40)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Not applicable	Not applicable to SSES. (See SER Section 3.3.2.1.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.3.1-41)	Cracking due to cyclic loading, SCC	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Steel closure bolting exposed to air with steam or water leakage (3.3.1-42)	Loss of material due to general corrosion	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Steel bolting and closure bolting exposed to air - indoor uncontrolled (external) or air - outdoor (external) (3.3.1-43)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Steel compressed air system closure bolting exposed to condensation (3.3.1-44)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Steel closure bolting exposed to air - indoor uncontrolled (external) (3.3.1-45)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water > 60°C (> 140°F) (3.3.1-46)	Cracking due to SCC	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry Program (B.2.14) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.3)
Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water (3.3.1-47)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry Program (B.2.14), or Closed Cooling Water Chemistry Program (B.2.14) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.4)
Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water (3.3.1-48)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry Program (B.2.14) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.5.)
Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water (3.3.1-49)	Loss of material due to MIC	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.3.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.3.1-50)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry Program (B.2.14) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.6.)
Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.3.1-51)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry Program (B.2.14) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.7)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water (3.3.1-52)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Heat Exchanger Inspection (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.10)
Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-53)	Loss of material due to general and pitting corrosion	Compressed Air Monitoring	No	Area-Based NSAS Inspection (B.2.46)	See SER Section 3.3.2.1.9
Stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation (3.3.1-54)	Loss of material due to pitting and crevice corrosion	Compressed Air Monitoring	No	Area-Based NSAS Inspection (B.2.46)	See SER Section 3.3.2.1.9
Steel ducting closure bolting exposed to air - indoor uncontrolled (external) (3.3.1-55)	Loss of material due to general corrosion	External Surfaces Monitoring	No	System Walkdown Program (B.2.32)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel HVAC ducting and components external surfaces exposed to air - indoor uncontrolled (external) (3.3.1-56)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Fire Water System Program (B.2.17)	Consistent with GALL Report
Steel piping and components external surfaces exposed to air - indoor uncontrolled (External) (3.3.1-57)	Loss of material due to general corrosion	External Surfaces Monitoring	No	System Walkdown Program (B.2.32)	Consistent with GALL Report
Steel external surfaces exposed to air - indoor uncontrolled (external), air - outdoor (external), and condensation (external) (3.3.1-58)	Loss of material due to general corrosion	External Surfaces Monitoring	No	System Walkdown Program (B.2.32) and Selective Leaching Inspection Program (B.2.29)	Consistent with GALL Report
Steel heat exchanger components exposed to air - indoor uncontrolled (external) or air - outdoor (external) (3.3.1-59)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	System Walkdown Program (B.2.32)	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air - outdoor (external) (3.3.1-60)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Not applicable	Addressed in line item 3.3.1-58 (See SER Section 3.3.2.1.1)
Elastomer fire barrier penetration seals exposed to air - outdoor or air - indoor uncontrolled (3.3.1-61)	Increased hardness, shrinkage and loss of strength due to weathering	Fire Protection	No	Fire Protection (B.2.16)	Consistent with the GALL Report
Aluminum piping, piping components, and piping elements exposed to raw water (3.3.1-62)	Loss of material due to pitting and crevice corrosion	Fire Protection	No	Not applicable	Not applicable to SSES (See SER Section 3.3.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel fire rated doors exposed to air - outdoor or air - indoor uncontrolled (3.3.1-63)	Loss of material due to wear	Fire Protection	No	Fire Protection (B.2.16)	Not Consistent with GALL Report (See SER Section 3.5.2.3.10)
Steel piping, piping components, and piping elements exposed to fuel oil (3.3.1-64)	Loss of material due to general, pitting, and crevice corrosion	Fire Protection and Fuel Oil Chemistry	No	Fuel Oil Chemistry Program (B.2.20) and Fire Protection Program (B.2.16) Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report
Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - indoor uncontrolled (3.3.1-65)	Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	Not applicable	Evaluated in LRA Table 3.5 (See SER Section 3.3.2.1.1)
Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - outdoor (3.3.1-66)	Concrete cracking and spalling due to freeze thaw, aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	Not applicable	Evaluated in LRA Table 3.5 (See SER Section 3.3.2.1.1)
Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - outdoor or air - indoor uncontrolled (3.3.1-67)	Loss of material due to corrosion of embedded steel	Fire Protection and Structures Monitoring Program	No	Not applicable	Evaluated in LRA Table 3.5 (See SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements exposed to raw water (3.3.1-68)	Loss of material due to general, pitting, crevice, and MIC, and fouling	Fire Water System	No	Fire Water System Program (B.2.17)	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-69)	Loss of material due to pitting and crevice corrosion, and fouling	Fire Water System	No	Fire Water System Program (B.2.17)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-70)	Loss of material due to pitting, crevice, and MIC, and fouling	Fire Water System	No	Fire Water System Program (B.2.17)	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to moist air or condensation (internal) (3.3.1-71)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Supplemental Piping/Tank Inspection Program (B.2.28)	Consistent with GALL Report
Steel HVAC ducting and components internal surfaces exposed to condensation (internal) (3.3.1-72)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) MIC	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Systems Walkdown program (B.2.32)	Consistent with GALL Report (See SER Section 3.3.2.1.8)
Steel crane structural girders in load handling system exposed to air - indoor uncontrolled (external) (3.3.1-73)	Loss of material due to general corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Crane Inspection Program (B.2.15)	Consistent with GALL Report
Steel cranes - rails exposed to air - indoor uncontrolled (external) (3.3.1-74)	Loss of material due to wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Not applicable	Evaluated in LRA Table 3.5 (See SER Section 3.3.2.1.1)
Elastomer seals and components exposed to raw water (3.3.1-75)	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Open-Cycle Cooling Water System	No	Not applicable	Evaluated in LRA Table 3.5 (See SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements (without lining/ coating or with degraded lining/coating) exposed to raw water (3.3.1-76)	Loss of material due to general, pitting, crevice, and MIC, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report
Steel heat exchanger components exposed to raw water (3.3.1-77)	Loss of material due to general, pitting, crevice, galvanic, and MIC, and fouling	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, nickel alloy, and copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-78)	Loss of material due to pitting and crevice corrosion	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-79)	Loss of material due to pitting and crevice corrosion, and fouling	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report
Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-80)	Loss of material due to pitting, crevice, and MIC	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report
Copper alloy piping, piping components, and piping elements, exposed to raw water (3.3.1-81)	Loss of material due to pitting, crevice, and MIC, and fouling	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report
Copper alloy heat exchanger components exposed to raw water (3.3.1-82)	Loss of material due to pitting, crevice, galvanic, and MIC, and fouling	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13)	Consistent with GALL Report
Stainless steel and copper alloy heat exchanger tubes exposed to raw water (3.3.1-83)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Piping Corrosion Program (B.2.13) Heat Exchanger Inspection (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.10)
Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to raw water, treated water, or closed cycle cooling water (3.3.1-84)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching Inspection Program (B.2.29) and Cooling Units Inspection Program (B.2.23)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Gray cast iron piping, piping components, and piping elements exposed to soil, raw water, treated water, or closed-cycle cooling water (3.3.1-85)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching Inspection Program (B.2.29)	Consistent with GALL Report
Structural steel (new fuel storage rack assembly) exposed to air - indoor uncontrolled (external) (3.3.1-86)	Loss of material due to general, pitting, and crevice corrosion	Structures Monitoring Program	No	Not applicable	Not applicable to SSES
Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water (3.3.1-87)	Reduction of neutron-absorbing capacity due to boraflex degradation	Boraflex Monitoring	No	Not applicable	Not applicable to BWRs
Aluminum and copper alloy > 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-88)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Not applicable	Not applicable to BWRs
Steel bolting and external surfaces exposed to air with borated water leakage (3.3.1-89)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Not applicable	Not applicable to BWRs
Stainless steel and steel with stainless steel cladding piping, piping components, piping elements, tanks, and fuel storage racks exposed to treated borated water > 60°C (> 140°F) (3.3.1-90)	Cracking due to SCC	Water Chemistry	No	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and steel with stainless steel cladding piping, piping components, and piping elements exposed to treated borated water (3.3.1-91)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Not applicable	Not applicable to BWRs
Galvanized steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (3.3.1-92)	None	None	No	None	Consistent with GALL Report
Glass piping elements exposed to air, air - indoor uncontrolled (external), fuel oil, lubricating oil, raw water, treated water, and treated borated water (3.3.1-93)	None	None	No	None	Consistent with GALL Report
Stainless steel and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.3.1-94)	None	None	No	None	Consistent with GALL Report
Steel and aluminum piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.3.1-95)	None	None	No	None	Consistent with GALL Report
Steel and stainless steel piping, piping components, and piping elements in concrete (3.3.1-96)	None	None	No	None	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.3.1-97)	None	None	No	None	Consistent with GALL Report
Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air (3.3.1-98)	None	None	No	None	Consistent with GALL Report
Stainless steel and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-99)	None	None	No	Not applicable	Not applicable to BWRs

The staff's review of the auxiliary systems component groups followed any one of several approaches. One approach, documented in SER Section 3.3.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.3.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.3.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the auxiliary systems components is documented in SER Section 3.0.3.

3.3.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.3.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- BWR Water Chemistry Program
- Flow-Accelerated Corrosion (FAC) Program
- Bolting Integrity Program
- Piping Corrosion Program
- Closed Cooling Water Chemistry Program
- Fire Water System Program
- Buried Piping Surveillance Program
- Fuel Oil Chemistry Program
- Chemistry Program Effectiveness Inspection

- Cooling Units Inspection
- Heat Exchanger Inspection
- Lubricating Oil Inspection
- Monitoring and Collection System Inspection
- Supplemental Piping/Tank Inspection
- Selective Leaching Inspection
- Buried Piping and Tanks Inspection Program
- System Walkdown Program
- Lubricating Oil Analysis Program
- Area-Based NSAS Inspection

LRA Tables 3.3.2-1 through 3.3.2-34 summarize AMRs for the auxiliary systems components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

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

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

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

Note D indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review and whether the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also

determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the engineered safety features ESF components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.3.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsections that follow.

3.3.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.3.1, item 36, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because Boraflex is not used as a neutron absorber for spent fuel racks at SSES. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES has no Boraflex as neutron absorber, and uses Boral instead. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.3.1, item 39, the applicant states that for this corresponding AMR result lines in the GALL Report, cracking due to SCC was not identified as an aging effect requiring management for stainless steel spent fuel storage racks because the temperature of the spent fuel pool is maintained well below 140°F. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that spent fuel temperature is maintained below 140 °F. In addition, the staff noted that SCC rarely occurs in austenitic stainless steel below 140 °F (Metals Handbook, 1988). Therefore, the staff finds that the corresponding AMR result lines in the GALL Report is not applicable to SSES.

In LRA Table 3.3.1, item 40, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because steel tanks in the Diesel Fuel Oil System are buried. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES has no steel tanks exposed to outdoor air in the Diesel Fuel Oil System. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.3.1, item 60, the applicant indicates that for this corresponding AMR result lines in the GALL Report, steel components that are exposed to air - outdoor (external) are evaluated in item 3.3.1-58. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that the components under this commodity group are addressed under item 3.3.1-58. In addition, steel components that are externally exposed to outdoor air are managed by the System Walkdown Program, which is consistent with the GALL Report for this item 3.3.1-60. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report are evaluated elsewhere in the application.

In LRA Table 3.3.1, items 49 and 62, the applicant indicates the component or the aging effects for these line items is not applicable. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that the components and the aging effect under this commodity group are not applicable to SSES. On this basis, the staff agrees with the applicant's corresponding AMR result line in the GALL Report is not applicable to SSES .

In LRA Table 3.3.1, items 65, 66 and 67, the applicant states that for these corresponding AMR result lines in the GALL Report, loss of material, cracking and spalling were not identified as an aging effects requiring management for reinforced concrete structural fire barriers exposed to indoor or outdoor uncontrolled air. The staff reviewed the documentation supporting the applicant's AMR evaluation and noted that reinforced concrete structural fire barriers were evaluated in the following tables: Table 3.5.2-2, 3.5.2-3, 3.5.2-4, 3.5.2-5, 3.5.2-6, 3.5.2-7, and 3.5.2-8. In addition, the staff noted that though the applicant did not identify loss of material, cracking and spalling as aging effects, the applicant did manage the components with Structure Monitoring Program and Fire Protection Program, which are consistent with the GALL Report. Therefore, the staff agrees with the applicant's management of the components under 3.3.1 items 65, 66, and 67.

In LRA Table 3.3.1, item 74, the applicant states that for these corresponding AMR result lines in the GALL Report, loss of material due to wear was not identified as an aging effect requiring management for steel cranes - rails exposed to indoor uncontrolled air. The staff reviewed the documentation supporting the applicant's AMR evaluation and noted that steel cranes rails were evaluated in the following tables: Table 3.5.2-2, 3.5.2-4, 3.5.2-6, 3.5.2-7, 3.5.2-8, and 3.5.2-10. In addition, the staff noted that though the applicant did not identify loss of material due to wear as an aging effect, the applicant did manage the components with Crane Inspection Program, which are consistent with the GALL Report. Therefore, the staff agrees with the applicant's management of the components under 3.3.1 item 74.

In LRA Table 3.3.1, item 75, the applicant states that hardening, loss of strength, and loss of material were not identified as aging effects requiring management for elastomers that are exposed to raw water in the Auxiliary Systems for SSES. The staff confirmed that line item 3.3.1-75 applies to GALL Report Item VII.C.1 and VII.C.2 in the service water system. The staff reviewed LRA Table 2.3.3-11, and Table 3.3.2-11, Emergency Service Water and noted that elastomers are not included in the scope of license renewal for this system. On the basis that elastomers in emergency service water system are not included in the scope of license renewal, the staff agrees with the applicant that item 3.3.1-75 is not applicable.

3.3.2.1.2 Cracking due to Stress Corrosion Cracking (SCC), Intergranular Stress Corrosion Cracking (IGSCC)

LRA Tables 3.3.2-3, 3.3.2-24, 3.3.2-25, 3.3.2-27, and 3.3.2-34 include AMR results for stainless steel components in an environment of treated water with temperature greater than 60°C (>140°F) and with an aging effect of cracking due to SCC or IGSCC. There are four AMR result lines in LRA Table 3.3.2-3 where the components are accumulators, filters, piping and valve bodies in the control rod drive hydraulic system; three lines in LRA Table 3.3.2-24 where the components are piping, tubing and valve bodies in the reactor non-nuclear instrumentation system; three lines in LRA Table 3.3.2-25 where the components are orifices, tubing, and piping and piping components in the reactor water cleanup system; one line in LRA Table 3.3.2-27 where the components are piping and piping components in the sampling system; and one line in LRA Table 3.3.2-34 where the components are piping and piping components in the reactor vessel and auxiliaries system (NSAS portions). For these AMR results, the applicant credited use of the BWR Water Chemistry Program, alone, with managing the aging effect. The applicant cited generic Note E, indicating that the result is consistent with the corresponding GALL Report item for material, environment and aging effect, but a different AMP is credited.

The staff noted that for the corresponding line in SRP-LR Table 3.3-1 and in GALL Report, Volume 1, Table 3, the recommended AMP is GALL AMP XI.M25, Closed-Cycle Cooling Water System, which includes both preventive measures, such as control of water chemistry, to minimize the potential for SCC and IGSCC, and inspection to monitor the effectiveness of the water chemistry program to control cracking due to SCC or IGSCC. Because the applicant recommended the BWR Water Chemistry Program, alone, and no inspection activity credited to monitor effectiveness of the chemistry program, the staff issued RAI 3.3-3 in a letter dated July 15, 2008, asking the applicant to justify why an inspection is not needed to verify the effectiveness of the water chemistry program and confirm that cracking is not occurring in these components.

In a letter dated August 15, 2008, the applicant responded to RAI 3.3-3 by providing the following response:

> For the AMR results identified in LRA Section 3.3 (Tables 3.3.2-3, 3.3.2-24, 3.3.2-25, 3.3.2-27, and 3.3.2-34) that refer to the GALL Report Item VII.E3-16, verification of the effectiveness of the BWR Water Chemistry Program is needed to confirm that cracking is not occurring in these components.
>
> The affected LRA Tables are revised to explicitly credit the Chemistry Program Effectiveness Inspection in combination with the BWR Water Chemistry Program.

The staff reviewed the applicant's response and all of the associated LRA changes. The staff noted that for all of the AMR results being questioned by the staff, the applicant revised the AMPs to be the BWR Water Chemistry Program in combination with the Chemistry Program Effectiveness Inspection, rather than the BWR Chemistry Program, alone. The revised AMR result lines continued to cite generic Note E, indicating that the material, environment and aging effect are consistent with the GALL Report, but a different aging management program is credited.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of cracking due to SCC or IGSCC. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the Chemistry Program Effectiveness Inspection is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and implements inspection methods that are capable of detecting cracking due to SCC or IGSCC, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection of the aging effect if it should occur, the staff finds the applicant's proposed AMPs for managing the potential aging effect of cracking due to SCC or IGSCC for stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F) in the control rod drive hydraulics system, the reactor non-nuclear instrumentation system, the reactor water cleanup system, the sampling system, and the reactor vessel and auxiliaries system (NSAS portions) to be acceptable. The staff also finds that the applicant's response to RAI 3.3-3, together with the associated LRA changes, resolves the issues raised in that RAI.

Based on the programs identified and the LRA changes made in response to RAI 3.3-3, the staff concludes that the applicant's AMR results are acceptable because the AMPs provide both detection and mitigation for the aging effect of cracking due to SCC and IGSCC in the subject components. For those items that apply to LRA Table 3.3.1, item 3.3.1-37, the staff determines that the LRA, as amended in response to an associated RAI, is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.3 Cracking Due to Stress Corrosion Cracking

In LRA Table 3.3.1, Item 3.3.1-46, addresses cracking due to stress corrosion cracking for stainless steel piping, piping components and heat exchanger components with the internal surfaces exposed to treated water greater than 140°F in the Reactor Building Closed Cooling Water System and Sampling System. The GALL Report recommends GALL AMP XI.M21, "Closed-Cycle Cooling Water System" to manage this aging effect. The staff noted that based on the applicant's response to RAI B.2.14-2 in letter dated August 12, 2008, the applicant amended the LRA so that the AMR line items in LRA Table 2 that reference this line item in GALL Report Table 1 also credit AMP B.2.22 "Chemistry Program Effectiveness Inspection" and cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff reviewed the AMR results lines that reference Note E and determines that the material, environment, and aging effect are consistent with the GALL Report.

The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing loss of material due to general, pitting and crevice corrosion for steel components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor

concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the Chemistry Program Effectiveness Inspection will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that AMR results addressed by this line item that credit these programs are acceptable.

3.3.2.1.4 Loss of Material Due to General, Pitting and Crevice Corrosion

In LRA Table 3.3.1, Item 3.3.1-47, addresses loss of material due to general, pitting, and crevice corrosion for steel chiller and piping components, tanks, pump casings, valve bodies and unit coolers with the internal surfaces exposed to treated water in the Process and Area Radiation Monitoring System, Reactor Building Chilled Water, HVAC and Closed Cooling Water Systems, and Control Structure Chilled Water and HVAC System. The GALL Report recommends GALL AMP XI.M21, "Closed-Cycle Cooling Water System" to manage this aging effect. The staff noted that based on the applicant's response to RAI B.2.14-2 in letter dated August 12, 2008, the applicant amended the LRA so that the AMR line items in LRA Table 2 that reference this line item in GALL Report Table 1 also credit AMP B.2.22 "Chemistry Program Effectiveness Inspection" and cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff reviewed the AMR results lines that reference Note E and determines that the material, environment, and aging effect are consistent with the GALL Report. By letter dated December 11, 2008, the applicant supplemented its response to RAI B.2.14-2 in which the applicant stated that the aging effect of loss of material for steel components exposed to a treated water environment in the Diesel Jacket Cooling Water System is managed only by the Closed Cooling Water Chemistry Program because corrosion probes have been installed. Further discussion is provided in SER Section 3.0.3.2.7 in which the applicant responded to RAI B.2.14-3. The applicant's supplemental response provided clarification as to why the CPEI was not credited for these steel components in the Diesel Jacket Cooling Water System, and these AMR line items are consistent with the GALL Report under GALL AMR Item VII.H2-23.

The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing loss of material due to general, pitting and crevice corrosion for steel components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage loss of material and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that AMR results addressed by this line item that credit these programs are acceptable.

3.3.2.1.5 Loss of Material Due to General, Pitting, Crevice and Galvanic Corrosion

In LRA Table 3.3.1, Item 3.3.1-48, addresses loss of material due to general, pitting, crevice and galvanic corrosion for steel chiller and heat exchanger components with the internal surfaces exposed to treated water in the Fuel Pool Cooling System, Containment Instrument Gas System, Reactor Building Chilled Water and Closed Cooling Water Systems, Reactor Water Cleanup System, Sampling System, Turbine Building Closed Cooling Water System and Control Structure Chilled Water System. The GALL Report recommends GALL AMP XI.M21, "Closed-Cycle Cooling Water System" to manage this aging effect. The staff noted that based on the applicant's response to RAI B.2.14-2 in letter dated August 12, 2008, the applicant amended the LRA so that the AMR line items in LRA Table 2 that reference this line item in GALL Report Table 1 also credit AMP B.2.22 "Chemistry Program Effectiveness Inspection" and cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff reviewed the AMR results lines that reference Note E and determines that the material, environment, and aging effect are consistent with the GALL Report.

The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing loss of material due to general, pitting, crevice, and galvanic corrosion for steel components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage loss of material and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that AMR results addressed by this line item that credit these programs are acceptable.

3.3.2.1.6 Loss of Material Due to Pitting and Crevice Corrosion

In LRA Table 3.3.1, Item 3.3.1-50, addresses loss of material due to pitting and crevice corrosion for stainless steel unit cooler, heat exchanger and chiller components, piping components, orifices, pump casings, tubing and valve bodies with the internal surfaces exposed to treated water in the Reactor Building Chilled Water, HVAC and Closed Cooling Water Systems, Sampling System, Diesel Generator Systems (Intake/Exhaust, Jacket Water, Lubricating Oil and NSAS Components) and Control Structure Chilled Water System. The GALL Report recommends GALL AMP XI.M21, "Closed-Cycle Cooling Water System" to manage this aging effect. The staff noted that based on the applicant's response to RAI B.2.14-2 in letter dated August 12, 2008, and supplemental response to RAI B.2.14-2 by letter dated December 11, 2008, the applicant amended the LRA so that the AMR line items in LRA Table 2 that reference this line item in GALL Report Table 1 also credit AMP B.2.22 "Chemistry Program Effectiveness Inspection" and cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff reviewed the AMR results lines that reference note E and determines that the material, environment, and aging effect are consistent with the GALL Report.

The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing loss of material due pitting and crevice corrosion for stainless steel components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage loss of material and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that AMR results addressed by this line item that credit these programs are acceptable.

3.3.2.1.7 Loss of Material Due to Pitting, Crevice and Galvanic Corrosion

In LRA Table 3.3.1, Item 3.3.1-51, addresses loss of material due to pitting, crevice and galvanic corrosion for copper and copper alloy chiller and heat exchanger components, piping and piping components and elements with the internal surfaces exposed to treated water in the Process and Area Radiation Monitoring System, Containment Instrument Gas System, Reactor Building Chilled Water, HVAC and Closed Cooling Water Systems, Sampling System and Control Structure Chilled Water, Diesel Generator Systems (Intake/Exhaust, Jacket Water, Lubricating Oil and NSAS Components) and Control Structure HVAC System. The GALL Report recommends GALL AMP XI.M21, "Closed-Cycle Cooling Water System" to manage this aging effect. The staff noted that based on the applicant's response to RAI B.2.14-2 in letter dated August 12, 2008, and supplemental response to RAI B.2.14-2 by letter dated December 11, 2008, the applicant amended the LRA so that the AMR line items in LRA Table 2 that reference this line item in GALL Report Table 1 also credit AMP B.2.22 "Chemistry Program Effectiveness Inspection" and cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff reviewed the AMR results lines that reference Note E and determines that the material, environment, and aging effect are consistent with the GALL Report.

The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing loss of material due to pitting, crevice, and galvanic corrosion for copper and copper alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage loss of material and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a

sample population of most susceptible subject components. On this basis, the staff finds that AMR results addressed by this line item that credit these programs are acceptable.

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

In LRA Table 3.3.1, Item 3.3.1-72, addresses loss of material due to general, pitting, crevice and microbiologically influenced corrosion for steel HVAC ducting and components internal surfaces exposed to condensation (internal) in the Primary Containment Atmosphere Circulation System. The GALL Report recommends GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to manage this aging effect. The AMR line items in LRA Table 2 that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff reviewed the AMR results lines that reference Note E and determines that the material, environment, and aging effect are consistent with the GALL Report.

The staff reviewed the applicant's AMP B.2.32 "System Walkdown Program" and its evaluation is documented in SER Sections 3.0.3.2.15. The staff determined that this aging management program which include surveillance activities and observations that are adequate to manage loss of material due to general corrosion for steel components exposed to ventilation (internal) addressed by this AMR are consistent with those activities recommend by GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." However the applicant is crediting the AMP B.2.32, which performs visual inspections of the external surfaces only, for the internal surfaces of fan and unit cooler housings. The staff felt that additional information was needed and therefore, by letter dated July 23, 2008, the staff issued RAI 3.x.2.1-1 requesting the applicant to justify the basis for crediting AMP B.2.32, which performs visual inspections of external surfaces only, for the internal surfaces of ducting and components internal surfaces exposed to condensation (internal) environments only. The applicant responded to RAI 3.x.2.1-1, in a letter dated August 22, 2008. The applicant stated that the internal and external surfaces of the ventilation components are exposed to the same environment because the function of this system is to circulate the air within containment. The staff noted that if condensation were to occur, that it is expected to form on the external surfaces of the components. The applicant further stated that visual inspections of the external surface for loss of material will be conservatively representative of the condition internal surface, because the external surface may be subjected to condensation. The staff noted that this is consistent with the recommendations given in the program element, "scope of program", of GALL AMP XI.M36 "External Surfaces Monitoring", in which a visual inspection of the external surfaces may be representative of the internal surfaces if the environment is the same for the external and internal surfaces. The staff noted that for the unit cooler housings the AMP B.2.23 "Cooling Units Inspection" will supplement the AMP B.2.32 "System Walkdown Program" because this component may be subjected to condensation on the internal surface and the staff confirmed that the AMP B.2.23 will provide verification if degradation has occurred on the internal surfaces of this component and the effectiveness of the AMP B.2.32 "System Walkdown Program" for managing loss of material. On the basis of its review, the staff finds the applicable portion of the applicant's response that references GALL Item VII.F3-3 to be acceptable because (1) the environments of the external surface and internal surface is the same and consistent with the recommendations provided in GALL that an visual inspection of the external surface can be credited for managing aging of the internal surfaces if the environments are the same and (2) the applicant has credited a one-time inspection to verify if degradation has occurred and the effectiveness of the Systems Walkdown Program when

condensation may form on the internal surface. On this basis, the staff finds this AMR results for this line item acceptable.

3.3.2.1.9 Loss of Material

LRA Table 3.3.1, line items 3.3.1-53 and 3.3.1-54 address the results of an AMR for steel and stainless steel compressed air piping, piping components, and piping elements exposed internal condensation, respectively. The applicant states that the aging effect requiring management is loss of material and proposes to use the Area-Based NSAS Inspection to manage the effects of aging.

The applicant has indicated generic Note E for this line item which is consistent with the GALL report for material, environment, and aging effect, but a different aging management program. The staff noted that the GALL Report recommends GALL AMP XI.M24, "Compressed Air Monitoring." The applicant cited a plant-specific note which states that internal condensation is collected in strainers, drain traps, tanks and associated piping and this moisture has conservatively been considered a raw water environment, but there is no resulting condensation on the external surface of the components. The staff noted that the applicant referenced the GALL AMR Items VII.D-2 and VII.D-4, which are applicable to compressed air systems, because the component/material/aging effect and environment combination corresponded to those that were applicable to the applicant, noting that the applicant conservatively considered internal condensation as raw water. The staff further noted that the piping and piping components applicable to this AMR that is being addressed here, in the Containment Instrument Gas and Service Air System, is not compressed air.

The staff's evaluation of the Area-Based NSAS Inspection is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting loss of material and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

3.3.2.1.10 Reduction of Heat Transfer due to Fouling

In its letter dated June 30, 2008, in response to RAI B.2.17-2, the applicant amended Table 3.3.2-13, Fire Protection System, to credit the Heat Exchanger Inspection Program to manage the aging effect of reduction of heat transfer due to fouling for copper alloy heat exchanger and oil cooler tubes in raw water internal environment. The applicant applied footnote "E" and referenced GALL Report Item VII.C1-6. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Heat Exchanger Inspection Program. The staff noted that these heat exchangers are not

included in the GL 89-13 program and will not therefore be in the scope of the Open-Cycle Cooling Water Program. The applicant instead uses the Fire Water System Program to manage loss of material due to corrosion, MIC or biofouling and includes actions to ensure no significant corrosion, MIC, or biofouling has occurred. However, in addition, the applicant has credited the one-time Heat Exchanger Inspection Program to provide direct evidence as to whether, and to what extent, reduction in heat transfer due to fouling has occurred or is likely to occur that could result in a loss of intended function.

On the basis that the applicant is crediting the Fire Water Inspection Program to ensure no significant fouling is occurring and crediting the Heat Exchanger inspection Program to obtain direct evidence of fouling, the staff finds that implementation of the Heat Exchanger Inspection will ensure that the heat transfer capabilities of the subject heat exchangers, and the pressure boundary integrity of the subject tubes, are maintained consistent with the current licensing basis during the period of extended operation.

In LRA Table 3.3.2-4, the applicant stated that reduction of heat transfer of control structure chilled water chiller evaporator copper and copper alloy tubes in an internal environment of treated water is managed by the Heat Exchanger Inspection Program.

The staff noted that the applicant applied Note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-52 and GALL Report Volume 2, item VII.C2-2. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M21, "Closed-Cycle Cooling Water System," the applicant proposed using the Heat Exchanger Inspection Program.

The GALL recommended AMP XI.M21, Closed-Cycle Cooling Water System, recommends preventive measures to minimize corrosion and testing and inspection to monitor the effects of corrosion, whereas the applicant is proposing only a one-time inspection activity. The staff noted that the heat exchangers in question are the chiller evaporators 0S118A/B and chiller oil cooler 0S119A/B. The applicant has credited the Closed-Cycle Cooling Water System program to manage loss of material for these two components and credited the Heat Exchanger Inspection Program to manage reduction of heat transfer. The staff noted that water chemistry is maintained by the Closed-Cycle Cooling Water System Program in accordance with the EPRI guidelines to minimize an aggressive environment. However, the applicant's Closed-Cycle Cooling Water System does not perform inspections for reduction of heat transfer due to fouling. The heat exchanger inspection will provide direct evidence as to whether, and to what extent, reduction in heat transfer due to fouling has occurred or is likely to occur that could result in a loss of intended function. On this basis, the staff finds that the implementation of the Heat Exchanger Inspection will ensure that the heat transfer capabilities of the subject heat exchangers are maintained consistent with the current licensing basis during the period of extended operation.

SER Section 3.3.2.1 Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent OE and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.3.2.2, the applicant further evaluates of aging management, as recommended by the GALL Report, for the auxiliary systems components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- reduction of heat transfer due to fouling
- cracking due to SCC
- cracking due to SCC and cyclic loading
- hardening and loss of strength due to elastomer degradation
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and MIC
- loss of material due to general, pitting, crevice, MIC and fouling
- loss of material due to pitting and crevice corrosion
- loss of material due to pitting, crevice, and galvanic corrosion
- loss of material due to pitting, crevice, and MIC
- loss of material due to wear
- loss of material due to cladding breach
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.3.2.2. The staff's review of the applicant's further evaluation follows.

3.3.2.2.1 Cumulative Fatigue Damage

LRA Section 3.3.2.2.1 states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2.

LRA Section 3.3.2.2.2 addresses reduction of heat transfer due to fouling. The applicant stated that there are no SSES components compared to LRA item number 3.3.1-03. For Auxiliary Systems, stainless steel heat exchanger tubes in treated water are evaluated under LRA item number 3.3.1-52. Fouling of stainless steel heat exchanger tubes in treated water is managed by the Closed Cooling Water Chemistry Program. The Closed Cooling Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. Based on review of plant-specific OE, the Closed Cooling Water Chemistry Program is effective in managing fouling through control of microorganisms and corrosion products.

SRP-LR Section 3.3.2.2.2 states that reduction of heat transfer due to fouling may occur in stainless steel heat exchanger tubes exposed to treated water. The existing program controls water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may be inadequate; therefore, the GALL Report recommends that the effectiveness of water chemistry control programs should be verified to ensure that reduction of heat transfer due to fouling does not occur. A one-time inspection is an acceptable method to ensure that reduction of heat transfer does not occur and that component intended functions will be maintained during the period of extended operation.

The staff noted that LRA Table 3.3.1, item 3.3.1-52 includes the same components, material and aging effect as LRA Table 3.3.1, item 3.3.1-3, and that the closed cycle cooling water environment is also a treated water environment. The staff reviewed the components evaluated under LRA Table 3.3.2, item 3.3.1-52 and noted that the only stainless steel heat exchanger components are for the diesel generator jacket water heat exchangers, which does not include primary water on either side of the heat exchanger tubes. Because the component, material and aging effects are identical and both environments are non-primary treated water, the staff finds it acceptable for the applicant to include the evaluations for LRA Table 3.3.1, item 3.3.1-3, with the evaluations for LRA Table 3.3.1, item 3.3.1-52. On this basis, the staff finds it acceptable to designate LRA Table 3.3.1, item 3.3.1-3 as not applicable.

Based on the above, the staff concludes SRP-LR Section 3.3.2.2.2 criteria is not applicable.

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.3 against the following criteria in SRP-LR Section 3.3.2.2.3:

(1) LRA Section 3.3.2.2.3 addresses cracking due to SCC in the BWR Standby Liquid Control System. The applicant stated that this aging effect is not applicable because the normal operating temperature is below 140°F during normal plant operation.

SRP-LR Section 3.3.2.2.3 states that cracking due to SCC may occur in the stainless steel piping, piping components, and piping elements of the BWR SLC system that are exposed to sodium pentaborate solution greater than 60°C (140°F). The existing AMP monitors and controls water chemistry to manage the aging effects of cracking due to SCC. However, high concentrations of impurities in crevices and with stagnant flow conditions may cause SCC; therefore, the GALL Report recommends that the effectiveness of water chemistry control programs should be verified to ensure that SCC does not occur. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the boundary drawing for the standby liquid control system and confirmed that all components of the system exposed to sodium pentaborate during normal operation are outside the drywell in an area of the reactor building that does not exceed 100°F during normal operation. The staff also noted that both the GALL Report and the SRP-LR state that the threshold for initiation of cracking due to SCC is a temperature greater than 60°C (>140°F). Because ambient temperature of the standby liquid control system components exposed to sodium pentaborate is below 60°C (<140°F) during normal plant operation, the staff finds that the aging effect of cracking due to SCC is not applicable for these components. On this basis, the staff finds it

acceptable for the applicant to designate LRA Table 3.3.1, item 3.3.1-4 as not applicable.

(2) LRA Section 3.3.2.2.3 addresses cracking due to SCC in heat exchanger components. The applicant stated that there are no SSES components that compare to LRA item number 3.3.1-05. The reactor water cleanup regenerative and nonregenerative heat exchangers at SSES are exposed to temperatures above 140°F, however, the components are carbon steel. Therefore, the applicant stated that this aging effect is not applicable because the heat exchanger components are carbon steel.

SRP-LR Section 3.3.2.2.3 states that cracking due to SCC may occur in stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 60℃ (140℉). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The line item 3.3.1-05 is applicable to the GALL items VII.E3-3 and VII.E3-19 in the reactor water cleanup system; however, at SSES these components are made of carbon steel. The applicant stated that other auxiliary systems have stainless steel heat exchanger components exposed to treated water greater than 60℃ (140℉), but these components are addressed in Table 3.3.1, line item 3.3.1-46. The staff confirmed that LRA Tables 3.3.2-22 and 3.3.2-27 identify these components for aging effect of cracking and are managed by the Closed Cooling Water Chemistry Program, which is consistent with the GALL Report. On the basis that the applicant has no stainless steel or stainless steel clad heat exchanger components exposed to treated water at temperatures greater than 60°C (>140°F) in the RWCU system, and that cracking due to SSC is not an expected aging effect applicable for carbon steel heat exchanger components, the staff finds it acceptable for the applicant to designate LRA Table 3.3.1, item 3.3.1-5, as not applicable.

(3) LRA Section 3.3.2.2.3 addresses cracking due to SCC in diesel engine exhaust piping, piping components, and piping elements. The applicant stated that this aging effect is not applicable because these components are exposed internally to ambient air, and remain dry during normal plant operation.

SRP-LR Section 3.3.2.2.3 states that cracking due to SCC may occur in stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

In a teleconference dated December 5, 2008, the staff had further discussion with the applicant on why cracking due to SCC was not considered to be an AERM for the stainless steel emergency diesel generator exhaust piping surfaces that are exposed internally to diesel exhaust. The applicant clarified that the AMR methodology identified that the emergency diesel generators are operating only periodically and that the exhaust environment that results from operations of the generators is not a source of contaminants and is dry.

In AMR Item AP-33 in Table II.A of NUREG-1833, "Technical Bases for Revision to the License Renewal Guidance Documents," the staff provides the following basis on why it is important to identify cracking due to SCC as an AERM for the internal surfaces of

stainless steel emergency diesel generator exhaust piping that are exposed to diesel exhaust (i.e. combusted diesel fuel).

> The Staff has accepted the position that the possible stress corrosion cracking of stainless steel diesel engine exhaust piping, piping components, and piping elements is managed by a plant-specific aging management program. The FCS SER section 3.3.2.4.3 identifies stainless steel as a material in diesel exhaust gas environment with loss of material and cracking as viable aging effects. GALL Rev. 0 Chapter VIIH.2.4-a only identifies carbon steel and loss of material due to general, pitting, and crevice corrosion of steel diesel engine combustion air exhaust subsystem components that are exposed to hot diesel engine exhaust gases containing moisture and particulates. Similar components constructed of stainless steel were observed to be susceptible to cracking in hot diesel exhaust gas. A plant-specific aging management program will be evaluated to provide reasonable assurance that the component's intended functions will be maintained within the CLB for the period of extended operation.

The diesel exhaust that results from operations of emergency diesel generators is made up mostly of carbon dioxide (CO2) and water (H2O) in the vapor state. However, there may be some amount of liquid state water (moisture) in the exhaust. Diesel exhaust may also contain some contaminants because the oil fractions that make up the diesel fuel prior to combustion may contain small percentages of nitrogen, sulfur or halogen atomic elements impurities. Thus, the staff noted that its basis in NUREG-1833 differed from the applicant's basis because NUREG supports that staff's basis that diesel exhaust could contain enough moisture and particulate containments and that these contaminants lead to cracking in the internal stainless steel emergency diesel generator exhaust piping surfaces that are exposed to the diesel exhaust environment. Thus, based on a comparison of the applicant's position against the relative information in NUREG-1833, the staff took the position that the applicant had not taken a conservative position relative to aging management of cracking due to SCC in the internal surfaces of stainless steel emergency diesel generator exhaust piping that are exposed to diesel exhaust. In a teleconference dated January 5, 2009, the staff discussed the applicant's basis for managing cracking in the stainless steel diesel generator exhaust piping, piping components, and piping elements that are exposed to a diesel exhaust environment. During this teleconference, the applicant stated that it would amend the LRA to identify cracking as an applicable aging effect for the internal stainless steel diesel generator exhaust piping, piping component, and piping element surfaces that are exposed to the diesel exhaust environment and that AMP B.2.28, Supplemental Piping and Tanks Inspection Program, will be credited to manage cracking in the internal component surfaces that are exposed to diesel exhaust.

The staff confirmed that the Supplemental Piping and Tanks Inspection Program includes a number of inspection methods, including volumetric (RT or UT) and visual (VT-1 or VT-3 or equivalent) examination techniques that will be performed by qualified personnel on a sample population of subject components. The staff noted that the Subsection IWA-2000 of the ASME Code Section XI lists volumetric and VT-1 visual examination techniques as valid inspection methods for the detection of cracking in metallic components. The staff also noted that GALL AMP XI.M32, "One-Time Inspection," indicates that one-time inspection programs are valid AMPs for cases

where: (1) the components may be susceptible to the gradual accumulation or concentration of agents that, if present, could promote certain aging effects, and (2) where additional verification is necessary in order to confirm that degradation is not occurring in the components or is progressing at a very slow propagation rate, or else to trigger additional corrective actions if unacceptable degradation is detected in the components.

The staff verified that, in the applicant's letter of January 12, 2009, the applicant made the appropriate changes to the AMRs for the stainless steel emergency diesel exhaust piping to credit the AMP B.2.28, Supplemental Piping and Tanks Inspection Program, for the management of cracking in the internal stainless steel diesel generator exhaust piping, piping component, and piping element surfaces that are exposed to diesel exhaust. The staff also verified that, in the applicant's letter of January 12, 2009, the applicant amended AMP B.2.28 to add these components to the scope of the AMP. Therefore, based on this assessment, the staff finds that the applicant has provided an acceptable basis for crediting the Supplemental Piping and Tanks Inspection Program for aging management of cracking because: (1) the emergency diesel generators are only periodically operated in accordance with plant technical specifications or transient operating procedures, (2) the applicant's basis is consistent with criteria in GALL AMP XI.M32 on when one-time inspection programs can be credited for aging management, and (3) the applicant's Supplemental Piping and Tanks Inspection Program includes volumetric examination methods and VT-1 or enhanced VT-1 visual inspection methods, which are valid techniques for the detection of cracking in the stainless steel components.

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.3.2.2.3 criteria. The staff determines that the LRA, as amended in response to a staff concern, is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.4 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

The staff reviewed LRA Section 3.3.2.2.4 against the following criteria in SRP-LR Section 3.3.2.2.4:

(1) LRA Section 3.3.2.2.4 addresses cracking due to SCC and cyclic loading in stainless steel PWR nonregenerative heat exchanger components exposed to treated borated water greater than 60°C (140°F) in the chemical and volume control system. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.3.2.2.4 states that cracking due to SCC and cyclic loading may occur in stainless steel PWR nonregenerative heat exchanger components exposed to treated borated water greater than 60°C (140°F) in the chemical and volume control system.

The staff confirmed in SRP-LR Table 3.3-1, Item 7, is only applicable to PWR plants.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.3.2.2.4.1 does not apply to SSES.

(2) LRA Section 3.3.2.2.4 addresses cracking due to SCC and cyclic loading in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 60°C (140°F). The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.3.2.2.4 states that cracking due to SCC and cyclic loading may occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 60°C (140°F).

The staff confirmed in SRP-LR Table 3.3-1, Item 8, is only applicable to PWR plants.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.3.2.2.4.2 does not apply to SSES.

(3) LRA Section 3.3.2.2.4 addresses cracking due to SCC and cyclic loading in stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.3.2.2.4 states that cracking due to SCC and cyclic loading may occur in the stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system. The existing AMP monitors and controls primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading; therefore, the effectiveness of water chemistry control programs should be verified to ensure that cracking does not occur.

The staff confirmed in SRP-LR Table 3.3-1, Item 9, is only applicable to PWR plants.

Because SSES is a BWR, the staff finds that this item in SRP-LR Section 3.3.2.2.4.3 does not apply to SSES.

Based on the above, the staff concludes SRP-LR Section 3.3.2.2.4 criteria are not applicable.

3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The staff reviewed LRA Section 3.3.2.2.5 against the following criteria in SRP-LR Section 3.3.2.2.5:

(1) LRA Section 3.3.2.2.5 addresses hardening and loss of strength due to elastomer degradation in components of heating and ventilation systems. The applicant stated that only the elastomers used in flexible connections in the Reactor Building HVAC and the Primary Containment Atmosphere Circulation System were identified as requiring aging management. Levels of ionizing radiation in the Reactor Building and of ionizing radiation and thermal exposure inside Containment exceeded threshold levels for cracking and changes in material properties. Elastomers in HVAC systems in other buildings do not exceed threshold levels for radiation or temperature. The System Walkdown Program is credited for aging management of elastomers in the Reactor Building HVAC and Primary Containment Atmosphere Circulation systems.

SRP-LR Section 3.3.2.2.5 states that hardening and loss of strength due to elastomer degradation may occur in elastomer seals and components of heating and ventilation systems exposed to air - indoor uncontrolled (internal/external). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.5.1 invokes AMR Item 11 in Table 3 of the GALL Report, Volume 1, and AMR Items VII.F1-7, VII.F2-7, VII.F3-7 and VII.F4-6 in the GALL Report, Volume 2, as applicable to elastomeric seals and components in control room, auxiliary and radwaste, primary containment, and diesel generator building heating and ventilation systems that are exposed either internally or externally to uncontrolled indoor air.

The staff reviewed LRA Section 3.3.2.2.5.1 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.5.1 and the recommendations for these components in GALL AMR Items VII.F1-7, VII.F2-7, VII.F3-7 and VII.F4-6, as applicable to the elastomeric seals and components in the control room, auxiliary and radwaste, primary containment, and diesel generator building HVAC systems that are exposed either internally or externally to uncontrolled indoor air.

The staff noted that the applicant aligned all of its AMR's for the elastomeric auxiliary system seals and components, as given in LRA Tables 3.3.2-7, "Aging Management Review Results – Diesel Generator Buildings HVAC Systems," 3.3.2-9, "Aging Management Review Results – Diesel Generators System," 3.3.2-5, "Aging Management Review Results – Control Structure HVAC Systems," 3.3.2-8, "Aging Management Review Results – Diesel Generator Buildings HVAC Systems," 3.3.2-16, "Aging Management Review Results – Primary Containment Atmosphere Circulation System," "3.3.2-13, "Aging Management Review Results – Fire Protection System," and 3.3.2-23, "Aging Management Review Results – Reactor Building HVAC System," to AMR Item 11 in Table 3 of the GALL Report, Volume 1, but also noted that the applicant was not always consistent in identifying whether hardening or loss of strength were applicable aging effects requiring management (AERMs).

Specifically, the staff noted that, in the applicant's AMRs for elastomeric components in the reactor building HVAC system and the primary containment air processing system that aligned to GALL AMR VII.F3-7, the applicant identified that cracking and changes in material properties were applicable AERMs only for the neoprene rubber or fiberglass flexible connections (expansion joints) in the reactor building HVAC system exposed to external uncontrolled indoor air and for neoprene expansion joints in the primary containment air processing system exposed to internal ventilation and external uncontrolled indoor air. For these components the applicant credited its Systems Walkdown Program to managing cracking and changes in material properties. The staff noted that the applicant did not identify cracking and changes in material properties as applicable AERMs for the internal neoprene rubber and fiberglass expansion joint surfaces in the reactor building HVAC system that are exposed to the ventilation environment and this was not consistent with the applicant's aging management approach taken for the analogous internal neoprene component surfaces in the primary containment air processing system.

The staff also noted that the applicant's ventilation and indoor air environment groupings, as given in LRA Tables 3.0-1 or 3.0-2, cover a range of specific environments and environmental conditions. In the applicant's environmental discussions for these

groupings, the staff noted insufficient evidence that the ventilation environment and the uncontrolled indoor air environment are equivalent. The applicant's discussion also did not establish the threshold being used for radiologically-induced aging and the maximum radiological levels the components would be exposed to, or whether the temperatures for the specific environments have the potential to exceed a thermally-induced aging threshold of 95°F.

The staff noted that the applicant had aligned the table 2 AMR items for the following supplemental HVAC or non-HVAC components to AMR Item 11 in Table 3 of the GALL Report, Volume 1 and either to GALL AMR VII.F1-7, VII.F2-7, VII.F3-7, or VII.F4-6:

> (1) silicone rubber heat exchanger tube plugs in the diesel generator intake exhaust systems under exposure to the ventilation environment,
>
> (2) elastomeric (synthetic rubber) flexible connections (hoses) in the diesel generator system, and fire protection system under external exposure to uncontrolled indoor air,
>
> (3) neoprene flexible connections in the diesel generator buildings HVAC system that are exposed internally to the ventilation environment and externally to the uncontrolled indoor air environment,
>
> (4) neoprene/asbestos flexible connections in the diesel generator buildings HVAC system and the control structure HVAC system that are exposed internally to the ventilation environment and externally to the uncontrolled indoor air environment, and
>
> (5) neoprene/fiberglass flexible connections in the diesel generator buildings HVAC system and the control structure HVAC system that is exposed internally to the ventilation environment and externally to the uncontrolled indoor air environment.

However, in these AMRs, the staff noted that the applicant did not identify any AERMs for the elastomeric/polymeric component surfaces that are exposed either to a ventilation air environment or an uncontrolled indoor air environment, and that in LRA Section 3.3.2.2.5.1, the applicant only justified this by stating the temperatures and radiation levels for the elastomers/polymeric materials in these systems "do not exceed threshold levels for radiation or temperature."

Thus, the staff had the following issues with the applicant's AMRs for the elastomeric and polymeric auxiliary system components that the applicant had aligned to AMR Item 11 in Table 3 of the GALL Report, Volume 1 and either to GALL AMR VII.F1-7, VII.F2-7, VII.F3-7, or VII.F4-6:

- The applicant did not provide sufficient evidence that the environmental conditions between the ventilation environments were equivalent to an uncontrolled, indoor air environment. Thus, for those elastomeric or polymeric components that the applicant had identified as being subject to the aging effects of "cracking" or "changes in material properties," the applicant did not provide sufficient basis why the external visual examinations performed under the Systems Walkdown Program could be used as the basis for managing

cracks/subsurface cracks that only break the internal surface or change in material property exposed to the ventilation environment.

- For those elastomeric or polymeric components that the applicant had identified as being subject to the aging effect of "changes in material properties," the applicant did not define the specific material properties that could be impacted by exposure to either the ventilation environment or the uncontrolled indoor air environment.

- The applicant did not provide a sufficient basis for concluding that there are not any applicable AERMs for the surfaces of the neoprene and fiberglass flexible connections in the reactor building HVAC that are exposed to internal ventilation when cracking and changes in material properties were identified as applicable AERMs for the neoprene expansion joints in the primary containment air processing system exposed to internal ventilation. Also the applicant did not provide the levels of ionizing radiation in the Reactor Building and of ionizing radiation and thermal exposure inside Containment that may have exceeded threshold levels for cracking and changes in material properties.

- For those supplemental HVAC or non-HVAC elastomeric or polymeric components that the applicant had aligned to the GALL item, but had not identified any applicable AERMs under exposure to an indoor air or ventilation environment, the applicant did not establish an acceptable basis for concluding that there are not any AERMS for the components. Specifically, the applicant did not establish how high the temperatures and radiation levels could reach under *the specific environmental conditions for the subsystems exposed to these* environments. Nor did the applicant identify the radiation level threshold for concluding that radiation-induced cracking or material property changes could occur in the polymetric/elastomeric materials used to fabricate these auxiliary system components.

In RAI 3.3.2.2.5.1-1, Part A, by letter dated July 23, 2008, the staff asked the applicant to specify the polymetric/elastomeric material properties that are within the scope of the applicant's aging effect "change in material properties." In RAI 3.3.2.2.5.1-1, Part B, by the same letter, the staff asked the applicant to justify, using a valid technical basis, why cracking and changes in material properties was not identified as an applicable AERM for the neoprene or fiberglass flexible connection (expansion joint) surfaces in the reactor building HVAC system that are exposed internally to the ventilation environment when these aging effects had been identified as AERMs for the neoprene expansion joint surfaces in the primary containment air processing system that are exposed internally to the ventilation system.

In its letter dated August 27, 2008, in response to RAI 3.3.2.2.5.1-1 Part A, the applicant stated that the specific material properties that could be impacted by exposure to either the ventilation or uncontrolled indoor air environment are hardening (e.g., embrittlement, decrease in elasticity) and loss of strength (e.g., elongation, loss of tensile strength, and, with exposure to ionizing radiation, swelling or melting). The applicant also stated that both types of material property changes could occur as a result of prolonged exposure to high temperature (95°F or higher), high radiation levels (equal to or greater than 10E6 rads total integrated dose (TID)), or to ultraviolet radiation or ozone.

In response to RAI 3.3.2.2.5.1-1 Part B, the applicant provided rationale for not identifying aging effects requiring management for neoprene or fiberglass flexible connections in the Reactor Building HVAC system. The applicant provided a summary of the stressors in the Reactor Building where these flexible connections are located. The applicant further stated that:

- There are no sources of ionizing radiation within the ventilation environment of the Reactor Building HVAC system that could cause the radiation levels to exceed the threshold level of 10E6 rads TID,

- There are no additional heat sources within the ventilation environment of the Reactor Building HVAC system that could contribute to prolonged thermal exposure to a temperature of 95°F or higher,

- The ventilation environment of the Reactor Building HVAC system contains no sources of ultraviolet radiation or ozone.

Therefore, the applicant concluded that for neoprene components in the Reactor Building HVAC system there are no aging effects requiring management.

The staff reviewed the applicant response to RAI 3.3.2.2.5-1, Parts A and B and finds the applicant response acceptable because (1) the applicant adequately defined the specific material properties that could be affected by exposure to ventilation atmosphere, and (2) the applicant identified the location where these flexible connections are located in the Reactor Building and defined the stressors that could cause the aging effects in neoprene flexible connections at those locations. The applicant response is consistent with the GALL Report definitions of neoprene material in Section IX and the threshold limits of the stressors as recommended in the GALL Report Section IX. On the basis of its review, the staff finds that neoprene flexible hoses in the Reactor Building HVAC system will not experience the aging effects of cracking and change in material properties in a ventilation environment.

In RAI 3.3.2.2.5.1-2, Part A, by letter dated July 23, 2008, the staff asked to applicant to clarify, using a valid technical basis, why the environmental conditions for an internal ventilation environment is considered to be equivalent to the environmental conditions that are applicable to an external uncontrolled indoor air environment. In RAI 3.3.2.2.5.1-2, Part B the staff asked the applicant, for each environment that is within the scope the "ventilation" environmental grouping or "indoor air/protected from weather" environmental grouping in the LRA, to identify and justify the basis the radiological-induced (gamma ray) aging threshold and threshold that is used to screen polymer/elastomer components in these environments for age related degradation (including cracking, hardening, loss of strength, or other material property changes), and to identify what the maximum-to-minimum temperature ranges and maximum gamma radiation levels are for these specific environments.

In its letter dated August 27, 2008, in response to RAI 3.3.2.2.5.1-2, the applicant stated the following for Part A:

> As described in LRA Table 3.0-1, internal ambient environments found inside components, such as piping and tanks that are either vented or otherwise open to the ambient conditions in their location, are also included in the "ventilation"

environment grouping. It is reasonable to assume that, for such components, the relevant conditions that can lead to aging, such as temperature and moisture, are the same both inside and outside the component. In these cases, the condition of the external surface is expected to be representative of the internal surface condition.

Also included in the "ventilation" environment grouping is ambient air that may be conditioned by filtering, heating, cooling, or dehumidification, or some combination thereof, in order to maintain a suitable environment for equipment operation or personnel occupancy. For components exposed internally to this environment, it is reasonable to assume that the relevant conditions that can lead to aging are generally less aggressive, or at least no more aggressive, than the ambient air to which the same components are exposed externally. In these cases, aging of the external surfaces is expected to progress at a faster rate than aging of the internal surfaces.

In both of these cases, the System Walkdown Program, which is consistent with the GALL AMP XI.M36 External Surfaces Monitoring, may be credited with aging management.

In response to Part B, the applicant stated that ionizing radiation, temperatures, and exposure to ultraviolet radiation and ozone were all within the threshold limits as recommended in the GALL Report. The applicant provided a table identifying the minimum and maximum normal operating temperature and the maximum total integrated dose for specific buildings/areas within the plant and within the scope of license renewal. The applicant stated that the maximum temperature in each building represents a hot spot or a design consideration for HVAC, and the temperature is not expected to equal or exceed 95°F for a prolonged period of time.

The staff reviewed the applicant response for RAI 3.3.2.2.5.1-2, Part A and finds that the applicant has provided an adequate technical basis to conclude that the internal ventilation environments are considered equivalent to or less aggressive than the external uncontrolled indoor-air environment. Therefore, the staff finds that the System Walkdown Program, which manages the aging effects of the external surfaces of the piping, can also be credited for the internal surfaces on the basis that these two environments are similar. The staff reviewed the applicant response for RAI 3.3.2.2.5.1-2, Part B and finds that the applicant has appropriately identified the temperatures and total integrated dose levels in the various structures that are within the scope of license renewal. The applicant response is consistent with the GALL Report definition of the threshold limits of the stressors as recommended in the GALL Report Section IX. On this basis, the staff finds the applicant response adequate.

In RAI B.2.32-4, the staff asked the applicant to justify its basis for crediting the System Walkdown Program to manage cracking and changes in material properties that may occur in the internal surfaces of in-scope components that are fabricated from either an elastomeric or polymeric material. The staff also asked the applicant to clarify how visual examinations alone from the external surfaces of these materials would be capable of detecting the following aging effects: (1) a tightly configured crack that penetrates the external surface of the component, (2) a subsurface crack or a crack that only penetrates the internal surface of the materials, and (3) a change in a material property, such as a potential change in the hardness property or strength property for the

elastomer or polymer material used to fabricate the component. RAI B.2.32-4 is relevant to the acceptance of the applicant's AMR basis for neoprene and fiberglass flexible connection (expansion joint) surfaces in the reactor building HVAC system and primary containment air processing system that are exposed internally to the ventilation environment or externally to the uncontrolled indoor air environment. The staff's acceptance of the System Walkdown Program to manage the aging effects of cracking and change of material properties for elastomers and the discussion of RAI B.2.32-4 are documented in SER Section 3.0.3.2.14. Based on this review, the staff concludes that the System Walkdown Program will adequately manage the aging effects of cracking and change in material properties of neoprene flexible hoses during the period of extended operation.

In RAI 3.3.2.2.5.1-3, Part A, and RAI 3.3.2.3-1 by letter dated July 23, 2008, the staff asked the applicant to provide its basis why there are not any applicable AERMs identified for the following component/material/environmental combinations:

(1) silicone rubber heat exchanger tube plugs in the diesel generator intake exhaust systems under exposure to the ventilation environment,

(2) elastomeric (synthetic rubber) flexible connections (hoses) in the diesel generator system and fire protection system under external exposure to uncontrolled indoor air,

(3) neoprene flexible connections in the diesel generator buildings HVAC system that are exposed internally to the ventilation environment and externally to the uncontrolled indoor air environment,

(4) neoprene/asbestos flexible connections in the diesel generator buildings HVAC system and the control structure HVAC system that are exposed internally to the ventilation environment and externally to the uncontrolled indoor air environment, and

(5) neoprene/fiberglass flexible connections in the diesel generator buildings HVAC system and the control structure HVAC system that is exposed internally to the ventilation environment and externally to the uncontrolled indoor air environment.

In RAI 3.3.2.2.5.1-2, Part B, the staff asked the applicant to identify what its thermally-induced and radiologically-induced thresholds are for concluding that thermally-induced and radiologically-induced cracking and changes in material properties could occur for the component/material/environmental combinations discussed in Part A of the questions and what the maximum temperature and radiation levels will be for the specific ventilation and/or indoor air environments that the system components are exposed to.

In its letter dated August 27, 2008, in response to RAI 3.3.2.2.5.1-3, Parts A and B, and RAI 3.3.2.3-1, the applicant provided a listing of the structures in which the above identified component/material/environment combinations is located. In all those locations, the applicant indicated that threshold limits for ionizing radiation, temperature, ultraviolet radiation and ozone levels will not be exceeded.

On the basis that the recommended threshold levels of the GALL Report will not be exceeded, the staff concludes that the identified component/material/environment combinations will not have any aging effects requiring management.

(2) LRA Section 3.3.2.2.5 addresses hardening and loss of strength due to elastomer degradation in spent fuel cooling and cleanup systems. The applicant stated that this aging effect is not applicable because elastomer linings do not perform an intended function.

SRP-LR Section 3.3.2.2.5 states that hardening and loss of strength due to elastomer degradation may occur in elastomer linings of the filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR) exposed to treated water or treated borated water. The GALL Report recommends that a plant-specific AMP be evaluated to determine and assess the qualified life of the linings in the environment to ensure that these aging effects are adequately managed.

For BWR designs, SRP-LR Section 3.3.2.2.5.2 invokes AMR Item 12 in Table 3 of the GALL Report, Volume 1, and AMR Item VII.A4-1 in the GALL Report, Volume 2, as applicable to elastomeric liners in BWR spent fuel cooling and cleanup systems that are exposed internally to the treated water environment of the spent fuel pool coolant

The staff verified that the applicant does not credit any elastomeric liners in the SSES fuel pool, fuel pool and cleanup system, or fuel pool auxiliaries for aging management. However, the staff noted that the applicant did align one other auxiliary system AMR for elastomeric components to the staff's AMR recommendations in AMR Item 12 in Table 3 of the GALL Report, Volume 1, and GALL AMR Item VII.A4-1. In this AMR, the applicant identified that the silicone rubber heat exchanger tube plugs in diesel generator intake and exhaust systems are exposed internally to a treated water environment and are within the scope of an AMR. In this AMR, the applicant stated that there are not any applicable aging effects requiring management (AERMs) for the internal tube plug surfaces that are exposed to a treated water environment. The staff noted that the applicant did not provide any basis for concluding that there are not any applicable AERMs for the tube plug surfaces that are exposed the treated water environment. The staff noted that, in contrast to the applicant's determination, GALL AMR VII.A4-1 identifies that elastomeric materials may degrade (i.e., harden or lose strength) under exposure to treated water.

In RAI 3.3.2.2.5.2-1, by letter dated July 23, 2008, the staff asked the applicant to justify its basis for concluding that the silicone tube plugs in the diesel generator intake/exhaust system heat exchangers would not degrade (i.e., harden or lose strength) for the tube plug surfaces that are exposed to the treated water environment.

In its letter dated August 27, 2008, in response to RAI 3.3.2.2.5.2-1, the applicant stated that change in material properties and cracking of elastomers, such as silicone, may be due to ionizing radiation, thermal exposure, or exposure to ultrasonic radiation or ozone.

The applicant further stated that:

- The silicone tube plugs are located in the Diesel Generator Buildings, where the total integrated dose is well below 10E6rads. Also, during normal plant operation, the silicone tube plugs are exposed to a treated

water environment that is not expected to contain or to release any measurable ionizing radiation.

- To ensure proper diesel generator operation, Diesel Generator Rooms A, B, C and D are individually ventilated and heated to maintain a temperature in the range of approximately 85°F to 95°F. Also, during normal plant operation, the diesel generators are in a standby mode, so the silicone tube plugs are exposed to a treated water temperature that is expected to be approximately the same as the ambient air temperature.

- The tube plugs are fabricated of silicone rather than natural rubber, and silicone has been demonstrated to have excellent resistance to ultraviolet radiation and ozone. The treated water environment associated with the Diesel Generator intake/exhaust system contains no sources of ultraviolet radiation or ozone.

Therefore, the applicant stated that change in material properties and cracking is not an aging effect requiring management because none of these stressors exceed their threshold limits.

The staff reviewed the applicant response to RAI 3.3.2.2.5.2-1, and finds the applicant response acceptable because (the applicant identified the location where these silicone tube plugs are located in the Diesel Generator Building and defined the stressors that could cause the aging effects at those locations. Although these silicone plugs are in a treated water environment, the staff noted that the stressors that could cause aging degradation in the diesel generator system and in the diesel generator building are not the same as in the spent fuel pool and cleanup system where a higher radiation level and temperatures could be experienced. The staff finds that the applicant's response provides an acceptable basis for concluding that cracking and changes in material properties are not applicable aging effects for these components because: (1) the environmental conditions are at temperatures less than or equal to 95°F and do not include sources of radiation or ozone, (2) this is consistent with the GALL Table IX.C that cracking and changes in material properties are only applicable aging effect if the component operating termperatures are greater than 95°F, or if they are exposed to radiation or ozone.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.5 criteria. For those line items that apply to LRA Section 3.3.2.2.5, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

The staff reviewed LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6.

LRA Section 3.3.2.2.6 addresses reduction of neutron-absorbing capacity and loss of material due to general corrosion. The applicant stated that these aging effects are not applicable because Boral, the neutron-absorbing medium, does not degrade as a result of long-term exposure to radiation, and Boral is stable, durable, and corrosion resistant.

SRP-LR Section 3.3.2.2.6 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion may occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or treated borated water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

During its review the staff noted the referenced GALL Report Item VII.A2-3 lists the aging effects as reduction of neutron absorbing capacity and loss of material due to general corrosion. However the AMR result line item in LRA Table 3.5.2-2 uses footnote E for the combination of Boral, treated water, loss of material and BWR Water Chemistry Program. Also during its review, the staff found industry operating experience of aluminum cations being found in the spent fuel pool water that could potentially be from the aluminum poison cans or from the Boral material made from aluminum-boron carbide composite. By letter dated June 13, 2008, the staff sent RAI 3.3.2.2.6-1 to ask the applicant whether plant-specific operating experience exists at SSES in which aluminum cations were found in the spent fuel pool water and to explain the source of the aluminum. The staff further asked the applicant to justify the basis for not crediting a one-time inspection to determine the effectiveness of the BWR Water Chemistry Program in managing these aging effects.

By letter dated July 24, 2008, the applicant stated in its response letter that SSES does not have plant-specific operating experience with respect to the presence of aluminum cations in the spent fuel pool. The staff noted that the industry operating experience related to the galvanic corrosion between the stainless steel enclosure and the aluminum clad is applicable to PWR's, because of the presence of boric acid in the spent fuel pool water which supports this type of corrosion. SSES is a BWR plant that does not contain boric acid in the spent fuel pool. SSES utilizes Boral plates which are contained in sealed tubes manufactured under an accepted Quality Assurance Program, which would prevent the spent fuel pool water from making contact with the Boral material. The applicant also provided plant-specific results from the Boral sample coupons. Half of the Boral coupon inventory are non-vented in order to simulate the expected conditions of the spent fuel pool where the water was not in contact with the Boral. The other half of the coupons were vented to simulate the conditions if the Boral was in contact with the spent fuel pool water. The applicant stated the results of the Boral coupons that were non-vented have not shown signs of blistering, pitting corrosion or loss of neutron-absorbing capacity. The results of the vented Boral coupons have shown some blistering on the edges, but neutron attenuation testing has shown the Boral has retained its design properties for neutron attenuation. On the basis of its review, the staff finds the applicant's response acceptable, because aluminum cations have not been found in the spent fuel pool water and the test results have not shown loss of neutron absorbing capability from Boral sample coupons representative of the poison cans in the spent fuel pool.

The staff noted that the applicant's proposed AMP for managing loss of material due to pitting and crevice corrosion is the BWR Water Chemistry Program, alone, without a confirmatory inspection program. The applicant had not provided sufficient justification to explain how the BWR Water Chemistry Program, alone, will provide adequate management for the potential aging effect of loss of material due to pitting or crevice corrosion, therefore the staff issued RAI 3.3-1 by letter July 15, 2008. The RAI asks the applicant to justify why an inspection program, such as the CPEI is not needed to confirm that age related degradation of the components is not occurring.

In a letter dated August 15, 2008, the applicant responded to RAI 3.3-1 by providing a response to the RAI, citing both industry and plant-specific data. Excerpts from that response are repeated below:

> The technical justification of the Boral neutron-absorbing capability aging assessment is based on plant-specific and industry operating experience. Loss of material of aluminum in treated water due to general corrosion is not an aging effect requiring management consistent with the GALL (e.g., VII.A4-5), but loss of material due to crevice and pitting corrosion is an aging effect requiring management and is managed by the BWR Water Chemistry Program...
>
> Industry Experience:
>
> A search of industry experience (INPO EPIX database) revealed ... that no instances of reduction of Boral neutron-absorbing capability have been experienced by other nuclear plants.
>
> SSES Plant-Specific Operating Experience:
>
> Half of the SSES Boral sample coupons are non-vented, simulating the expected condition at the racks. These have not shown any blistering, pitting corrosion or loss of neutron-absorbing capability. The other half of the SSES Boral coupons are vented, simulating a portion of the fuel rack having a bad weld, allowing water into the area with the Boral plates. These vented samples have shown blistering near the edges of the plate due to the porous nature of the cut edge of the plate, where water interacts with the Boron matrix and radiation to generate gases that blister the plate. This effect has, in some cases, caused the outer metal layer of the Boral plate (sample) to blister out and press flat against the outer tube that contains it. This contact in a demineralized water environment has shown no signs of galvanic or other corrosion. Neutron attenuation testing has shown that these plates still retain the required design properties for neutron attenuation. Weighing of the samples has shown no loss of material, although some minor gains in weight (post drying) may be related to the water intrusion/interaction with decay products.
>
> The most recent Boral coupon tests (year 20 coupon test) for Units 1 and 2 were performed by independent testing facilities in 2003 and 2005, respectively. The range of water chemistry conditions to which the Boral coupons were subjected are within the fuel pool chemistry specification limits as delineated in the Susquehanna Chemistry Manual.

By letter dated April 13, 2009, the staff sent RAI 3.3.2.2.6-2 to ask the licensee to describe the decay products that were said to be responsible for minor weight gains in the Boral surveillance coupons. The licensee responded in letter dated May 13, 2009 that the decay products are corrosion products from the oxidation of aluminum. The staff has reviewed the information and has found it acceptable, since there would be some aluminum corrosion products present due to general corrosion of aluminum following initial installation.

By letter dated August 15, 2008, the licensee described the Boral coupon testing program. Boral sample coupons are removed from the spent fuel pool periodically for testing and evaluated for corrosion or other degradation of the neutron absorber by comparing various physical characteristics. Additional Boral coupons are scheduled to be removed from the spent fuel storage pool and analyzed at years 30 and 40 under a current licensing commitment per UFSAR Section 9.1.2.3.3.

By letter dated April 13, 2009, the staff sent RAI 3.3.2.2.6-3 to ask the licensee additional questions about the Boral coupon testing. The licensee responded in a letter dated May 13, 2009 that there were three sets of coupons left in each unit's pool. The licensee also made Commitment 61 to continue Boral coupon testing in the period of extended operation. The staff had a teleconference with the licensee on May 21, 2009 to clarify Commitment 61. In response dated May 28, 2009 the licensee made an amendment to Commitment 61 to add: "SSES UFSAR section 9.1.2.3.3 Inservice Inspection will be revised to identify the coupon testing schedule during the period of extended operation. SSES UFSAR section 9.1.2.3.3.2. Test Coupon Inspection will be revised to require neutron attenuation testing as part of the inspection of test coupons removed from the spent fuel pool." The staff has reviewed the response and commitment to perform Boral coupon testing including neutron attenuation testing in the period of extended operation. The staff finds this acceptable since SSES has a sufficient amount of coupons to perform the testing, providing assurance that degradation of the neutron absorbing material would be detected. The staff finds that the commitment to revise the UFSAR to reflect the changes above is acceptable since the revision would provide adequate assurance that the Boral coupon testing would be performed in the period of extended operation. Therefore, the staff has found the response and commitment to be acceptable.

From the RAI responses dated August 15, 2008, and May 13, 2009, the licensee described the Water Chemistry Program. Based on SSES plant-specific experience of Boral coupon inspections and testing, the loss of material aging effect has been and will continue to be adequately managed by the BWR Water Chemistry Program. The BWR Water Chemistry Program would monitor and control water chemistry parameters within limits to mitigate loss of material due to crevice or pitting corrosion. The scheduled Boral sample coupon testing is a verification of effectiveness of the credited BWR Water Chemistry program. The staff also notes that both industry and current plant-specific operating experience show that aging effects do not occur or progress very slowly for Boral neutron-absorbing sheets exposed to treated water in a spent fuel pool. The staff has reviewed this response and has determined that the Water Chemistry Program, as validated by the Boral coupon testing program, will adequately manage loss of material in the period of extended operation.

The staff reviewed the BWR Water Chemistry Program which will control the quality of the spent fuel pool water to prevent the loss of material of the aluminum cladding and boron-carbide materials within. The staff's evaluation of the BWR Water Chemistry Program is documented in SER Section 3.0.3.1.1. The applicant has demonstrated with industry and plant-

specific experience that aging effects do not occur or progress very slowly in a treated water environment and the commitment for continued Boral coupon testing provides confirmation of the effectiveness of the BWR Water Chemistry Program. The staff finds crediting of the BWR Water Chemistry Program, for managing the aging effects of loss of material of the Boral neutron-absorbing sheets exposed to treated water in the spent fuel pool to be acceptable.

By letter dated April 13, 2009, the staff sent RAIs 3.3.2.2.6-5 through 3.3.2.2.6-6 to ask the licensee additional questions about operating experience. The licensee responded in a letter dated May 13, 2009 with the following excerpts:

> "Testing of Boral coupons at Susquehanna has continued and although some blistering of the aluminum cladding has been observed on vented test coupons, evaluations have shown that the boron areal density remains within specification.
>
> The unvented coupons have always been found in the as-fabricated condition with the surface appearing as mill finish Boral. The vented coupons have shown signs of surface blistering, but the blisters (where aluminum clad delaminated from core) are only conditions of appearance and have not had any affect on the Boral neutron absorbing capacity.
>
> In September 2008, an attempt to remove an irradiated fuel assembly from storage cell location PP-2 in the SSES Unit 1 Spent Fuel Storage Pool (SFSP) was unsuccessful. That particular fuel assembly currently remains in cell PP-2, and the surrounding/adjacent cells currently do not have fuel stored in them. Visual inspections of the surrounding cells have not identified any poison can deformation or the presence of any foreign material causing interference with the assembly. PPL has not determined the cause of this condition in the PP-2 storage cell at this time.
>
> As a result of the issue with the assembly in the PP-2 Unit 1 SFSP cell, and a previous incident in March 2006 in which a blade guide could not be inserted into the Unit 1 SFSP cell C-13, a visual inspection of cell C-13 was performed during the recent Unit 2 14th refueling and inspection outage (U2-14RIO) in May 2009. Significant bulging of one of the four poison can walls was observed. The cell is currently empty and will not be used for storage. Cell C-13 and the surrounding adjacent cells historically have been reserved for storage of non-fuel components (e.g., blade guides) and are not used to store spent fuel assemblies. The condition of cell C-13 has been entered into the SSES Corrective Action Program for evaluation and determination of necessary follow-up activities. Although the cause of the deformation in cell C-13 has not yet been determined, industry operating experience suggests it may be the result of hydrogen gas generation from either moisture contained in the Boral at the time of manufacture or a leaking seal weld in the poison can.
>
> The Susquehanna SFSPs contain over 5000 locations where spent fuel assemblies are typically stored. During fuel handling activities over the past few years, and in particular, during the most recent fuel movements prior to and during the U2-14RIO, no other significant interference issues have been encountered, nor have there been any other similar observations of rack deformation. This suggests the issues related to cells PP-2 and C-13 are isolated incidents and are not indicative of a widespread fuel storage rack

problem. Further evaluations and follow-up actions are being conducted via the SSES Corrective Action Program. Based on the evaluations that have been performed to-date and past industry experience, PPL finds that there is no current safety concern with the Susquehanna SFSPs.

In addition to the recent SSES operating experience, [EPRI Technical Report, "Handbook of Neutron Absorber Materials for Spent Nuclear Fuel Transportation and Storage Applications, "November 2006 edition] includes a summary of in-service experience with Boral. The two primary issues identified in the summary of operating experience are loss of material due to corrosion and blistering of the aluminum cladding of the Boral sheets. As discussed in response to the preceding RAIs, these issues are not safety concerns for Susquehanna. Neither corrosion or blistering has resulted in loss of neutron absorbing capability of the Boral material at Susquehanna, and [EPRI Technical Report, "Handbook of Neutron Absorber Materials for Spent Nuclear Fuel Transportation and Storage Applications, "November 2006 edition] reaches a similar conclusion based on the operating experience reported in that document. PPL is not aware of any other operating experience that is applicable to Susquehanna."

The staff has reviewed and confirmed the operating experience and finds this acceptable since the operating experience supports the conclusion that the implementation of the Boral coupon testing will continue to be able to manage the loss of neutron-absorbing capacity and degradation of Boral effectively.

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.3.2.2.6 criteria. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.7 against the following criteria in SRP-LR Section 3.3.2.2.7:

(1) LRA Section 3.3.2.2.7 addresses loss of material due to general, pitting, and crevice corrosion in the reactor coolant pump oil collection system. The applicant stated that this aging effect is not applicable because the SSES primary containment is inerted during normal operation, which meets the requirements of item III.O in 10 CFR Part 50 Appendix R.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements, including the tubing, valves, and tanks in the reactor coolant pump oil collection system, exposed to lubricating oil (as part of the fire protection system). The existing AMP periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection

of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation. In addition, corrosion may occur at locations in the reactor coolant pump oil collection tank where water from wash-downs may accumulate; therefore, the effectiveness of the program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion, including determination of the thickness of the lower portion of the tank. A one-time inspection is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff verified that only piping, piping components and elements that align to GALL AMR VII.F1-19 and VII.H2-20 for the Fire Protection, Reactor Building Chilled Water, Control Structure Chilled Water and Diesel Generator Lubricating Oil and NSAS Component Systems that are fabricated from steel materials are applicable to SSES.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.2.13 respectively. The staff reviewed the applicant's Lubricating Oil Analysis Program and determined that this program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to general, pitting and crevice corrosion for steel piping, piping components and elements exposed to lubricating oil internally or externally. The staff verified that the applicant has credited its Lubricating Oil Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program to manage this aging effect. The applicant's AMPS are consistent with those recommended for aging management in SRP-LR Section 3.3.2.2.7, Item #1 and in GALL AMR Items VII.F1-19 and VII.H2-20.

Based on the program identified above, the staff concludes that the applicant's program meet SRP-LR 3.3.2.2.7 Item #1 criteria and therefore the applicant's AMRs are consistent with those under GALL Report Item VII.F1-19 and VII.H2-20. For those line items that apply to LRA Section 3.3.2.2.7 Item #1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.7, item 1 states that item numbers 3.3.1-15 and 3.3.1-16 of LRA Table 3.3.1 are not applicable to SSES, which align to the GALL Report Items VII.G-26 and VII.G-27. The staff noted that SSES is of BWR design and contains a primary containment that is inerted during normal operation, thus SSES meets the requirements of 10 CFR Part 50 Appendix R Section III.O, and is not required to have an oil collection system for the reactor coolant pump by the rule. The staff confirmed that since SSES is a BWR with an inert primary containment atmosphere, it has no reactor coolant pump oil collection system. Therefore, aging of the piping, tubing, valves bodies, and tanks in the reactor coolant pump oil collection system are not applicable for SSES. Thus, the staff finds the applicant's conclusion that the aging effect loss of material due to general, pitting and crevice corrosion is not applicable to SSES, acceptable because SSES does

not have a reactor coolant pump oil collection system and GALL Items VII.G-26 and VII.G-27 do not apply.

(2) LRA Section 3.3.2.2.7 addresses loss of material due to general, pitting, and crevice corrosion in the BWR reactor water cleanup and shutdown cooling systems. The applicant stated that loss of material due to general, pitting, and crevice corrosion for steel piping components exposed to treated water is managed by the BWR Water Chemistry Program. The BWR Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the BWR Water Chemistry Program to manage loss of material due to general, pitting, and crevice corrosion through examination of steel piping components.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements in the BWR reactor water cleanup and shutdown cooling systems exposed to treated water. The existing AMP monitors and controls reactor water chemistry to manage the aging effects of loss of material from general, pitting, and crevice corrosion. However, high concentrations of impurities in crevices and with stagnant flow conditions may cause general, pitting, or crevice corrosion; therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff noted that in addition to applying this AMR result for reactor water cleanup system components, the applicant also applied this AMR result for carbon steel piping and valve bodies exposed to treated water in the fuel pool cooling and cleanup system and fuel pools and auxiliaries (LRA Table 3.3.2-14, pages 3.3-253 and 3.3-357), for carbon steel piping components exposed to treated water in the process and area radiation monitoring system (LRA Table 3.3.2-17, page 3.3-269), for carbon steel accumulators, piping, valve bodies, and piping and piping components exposed to treated water in the control rod drive hydraulics system (LRA Table 3.3.2-3, pages 3.3-102, 3.3-105, 3.3-107, and 3.3-108), and for carbon steel accumulators exposed to treated water in the standby liquid control system (LRA Table 3.3.2 31, page 3.3-339). For all of these AMR result lines, the applicant proposed to manage the aging effect of loss of material for carbon steel components in a treated water environment with a combination of the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to general, pitting, and crevice corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material

due to general, pitting and crevice corrosion, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection of the aging effect if it should occur, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to general, pitting, and crevice corrosion for carbon steel components exposed to treated water in the reactor water cleanup system, the fuel pool cooling and cleanup system and fuel pools and auxiliaries, the process and area radiation monitoring system, the control rod drive hydraulics system, and the standby liquid control system to be acceptable.

(3) LRA Section 3.3.2.2.7 addresses loss of material due to general, pitting, and crevice corrosion in diesel exhaust piping, piping components, and piping elements. The applicant stated that loss of material due to general corrosion for steel piping components exposed to diesel exhaust is managed by the System Walkdown Program. Loss of material due to corrosion was not identified as an applicable aging effect for the stainless steel diesel exhaust piping flexible connections and tubing which are located inside the diesel generator buildings. The diesel exhaust system is normally in standby mode and the inside surfaces of the components are dry and not subject to any type of wetting.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general (steel only), pitting, and crevice corrosion may occur in steel and stainless steel diesel exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.3.2.2.7.3 references AMR item 18 in Table 3 of the GALL Report, Volume 1 and AMR item VII.H2-2 in Table VII.H2 of the GALL Report, Volume 2 as the applicable AMRs for evaluating loss of material due to general, pitting, and crevice corrosion in steel and stainless steel diesel generator piping, piping components, and piping elements that are exposed to a diesel exhaust environment. The aging management guidance in these AMRs for diesel generator exhaust piping is consistent with that given SRP-LR Section 3.3.2.2.7.3.

The staff noted that the applicant's AMR items on loss of material in emergency diesel generator exhaust piping components are given in AMR item 3.1.1-18 of LRA Table 3.3.1 and in the AMR items in LRA Table 3.3.2-9, "Aging Management Review Results – Diesel Generators System," that have reference links LRA AMR item 3.1.1-18. The staff confirmed that LRA Table 3.3.2-9 did include AMRs for the managing loss of material due to general, pitting, and crevice corrosion in internal steel emergency diesel generator piping, piping components, and piping elements surfaces that are exposed to a ventilation environment and that these AMRs were referenced to GALL AMR VII.H2-2. The staff also confirmed that in these AMRs, the applicant credited AMP B.2.32, Systems Walkdown Program, to manage loss of material in the internal steel diesel generator exhaust piping, piping components, and piping element surfaces that are exposed to a ventilation (in this case diesel exhaust) environment.

The staff noted that its Systems Walkdown Program, the applicant identifies that the AMP is consistent the staff's recommended program elements in GALL AMP XI.M36, "External Surfaces Monitoring Program," which is a program that is credited only for managing loss of material that occurs in external metal component surfaces, or for aging management of their external paint or coating surfaces in the components are

painted or coating with plastic coatings. The staff also noted that the "scope of program" program element in GALL AMP XI.M36 states the a program corresponding to the GALL AMP XI.M36 may only be used to internal component surfaces if the "material and environment combinations are the same for internal and external surfaces such that external surface condition is representative of internal surface condition."

The staff noted that, in LRA Table 3.0-1 of the application, the applicant equates the emergency diesel generator exhaust environment to be the equivalent of the applicant's "ventilation environment" for the application, which is defined by the applicant as follows:

> Ventilation air and compressed air and gases. Ventilation air is defined as ambient air that is conditioned to maintain a suitable environment for equipment operation or personnel occupancy. Ventilation air may be conditioned by filtering, heating, cooling, dehumidification or some combination.
>
> Internal ambient environments found inside components such as piping and tanks that are either vented or otherwise open to the ambient conditions in their location are also included under this environment, as are exhaust gases, such as from a diesel engine.
>
> While ventilation is predominantly an internal environment, the external surfaces of mechanical components may be exposed to ventilation (e.g., cooling unit tubes in HVAC systems).
>
> Comparable GALL environments: Air – Indoor Uncontrolled, Air – Outdoor, Condensation, Diesel Exhaust

The diesel exhaust that results from operations of emergency diesel generators is made up mostly of carbon dioxide (CO2) and water (H2O) in the vapor state. However, there may be some amount of liquid state water (moisture) in the exhaust. Diesel exhaust may also contain some contaminants because the oil fractions that make up the diesel fuel prior to its combustion may contain small percentages of nitrogen, sulfur or halogen atomic elements impurities. These type of environmental conditions are reflected in the staff's environmental description in GALL Table IX.D for diesel exhaust, which states that diesel exhaust contains "gases, fluids, and particulates." The staff took issue with equating the diesel exhaust environment to the indoor ventilation environment that would be on the outside of these piping, piping components, and piping elements because the diesel exhaust could contain significant levels of moisture and contaminants that are not normally present in the indoor ventilation air. Thus, the staff was of the opinion that the applicant was not justified in crediting the System Walkdown Program for managing loss of material the internal emergency diesel generator piping, piping component, and piping element surfaces that are exposed to diesel exhaust because the diesel exhaust could create more harsh conditions than would the normal ventilated air inside of the diesel generators rooms.

In a teleconference dated January 5, 2009, the staff discussed the applicant's basis for managing loss of material in the steel stainless steel diesel generator exhaust piping, piping components, and piping elements that are exposed to a diesel exhaust environment. During this teleconference, the applicant stated that it will amend the LRA to identify loss of material as an applicable aging effect for the internal steel and

stainless steel diesel generator exhaust piping, piping component, and piping element surfaces that are exposed to the diesel exhaust environment and to credit a one-time examination of the internal components surfaces using the examinations techniques of the AMP B.2.28, Supplemental Piping and Tanks Inspection Program for aging management of this aging effect.

The staff confirmed that the applicant's Supplemental Piping and Tanks Inspection Program is a one-time inspection program for miscellaneous plant piping and tank components and that the AMP credits a combination of established volumetric (RT or UT) and visual (VT-1 or VT-3 or equivalent) examination techniques performed by qualified personnel on a sample population of subject components. The staff noted that the Subsection IWA-2000 of the ASME Code Section XI lists volumetric and VT-1 visual examination techniques as valid inspection methods for the detection of cracking in metallic components. The staff also noted that GALL AMP XI.M32, "One-Time Inspection," indicates that one-time inspection programs are valid AMPs for cases where: (1) the components may be susceptible to the gradual accumulation or concentration of agents that, if present, could promote certain aging effects, and (2) where additional verification is necessary in order to confirm that degradation is not occurring in the components or is progressing at a very slow propagation rate, or else to trigger additional corrective actions if unacceptable degradation is detected in the components.

The staff verified that, in the applicant's letter of January 12, 2009, the applicant made the appropriate changes to the AMRs for the steel stainless steel emergency diesel exhaust piping, piping components, and piping elements to credit the AMP B.2.28, Supplemental Piping and Tanks Inspection Program, to manage loss of material in the internal steel and stainless steel diesel generator exhaust piping, piping component, and piping element surfaces that are exposed to diesel exhaust. The staff also verified that, in the applicant's letter of January 12, 2009, the applicant made amended AMP B.2.28 to add the diesel exhaust piping to the scope of the AMP. Therefore, based on this assessment, the staff finds that the applicant has provided an acceptable basis for crediting the Supplemental Piping and Tanks Inspection Program for aging management of loss of material in these components because: (1) the emergency diesel generators are only periodically operated in accordance with plant technical specifications or transient operating procedures, (2) the applicant's basis is consistent with criteria in GALL AMP XI.M32 on when one-time inspection programs can be credited for aging management, and (3) the applicant's Supplemental Piping and Tanks Inspection Program includes volumetric examination methods and VT-1 or VT-3 visual inspection methods, which are valid techniques for the detection of loss of material in these steel and stainless steel diesel exhaust components.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7 criteria. For those line items that apply to LRA Section 3.3.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

The staff reviewed LRA Section 3.3.2.2.8 against the criteria in SRP-LR Section 3.3.2.2.8.

LRA Section 3.3.2.2.8 addresses loss of material due to general, pitting, crevice, and microbiologically influence corrosion (MIC). The applicant stated that loss of material due to general, pitting, and crevice corrosion and MIC for steel piping components with coatings buried in soil is managed by the Buried Piping and Tanks Inspection Program. Loss of material for buried steel piping components with damaged coatings and buried in soil is managed by the Buried Piping Surveillance Program.

SRP-LR Section 3.3.2.2.8 states that loss of material due to general, pitting, and crevice corrosion, and MIC may occur in steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. Buried piping and tanks inspection programs rely on industry practice, frequency of pipe excavation, and OE to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and OE with buried components, ensuring that loss of material does not occur.

The Buried Piping and Tanks Inspection Program is discussed in SER Section 3.0.3.2.13. The Buried Piping and Tanks Inspection Program relies on examination of buried steel piping and piping components with coatings during routine maintenance or by using focused inspections at least once in the ten years prior to entering the period of extended operation and at least once during the first ten years of entering the period of extended operation. The Buried Piping Surveillance Program is discussed in SER Section 3.0.3.2.10. The Buried Piping Surveillance Program relies on the use of cathodic protection to protect buried steel piping with damaged coatings. Reference electrodes are placed along the buried piping which are used to measure the potential of the buried piping to ensure that it is adequately protected by the cathodic protection system. In addition, coating conduction measurements are taken to indicate that the protective coatings are adequately installed, and current requirements are trended to insure that further damage to the coatings is not occurring. Finally, pipe to soil potential surveys are performed on an annual basis to further demonstrate adequate protection of the buried steel piping with damaged coatings.

Based on the programs identified, the staff concludes that the applicant's AMR results are acceptable because the AMPs provide both detection and mitigation for the aging effect of loss of material due to general, pitting, and crevice corrosion and MIC for steel piping components with coatings buried in soil in the subject components. For those items that apply to LRA Table 3.3.1, item 3.3.1 19 and Table 3.4.1, item 3.4.1-17, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.8 criteria. For those line items that apply to LRA Section 3.3.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.9 Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling

The staff reviewed LRA Section 3.3.2.2.9 against the following criteria in SRP-LR Section 3.3.2.2.9:

(1) LRA Section 3.3.2.2.9 addresses loss of material due to general, pitting, crevice, MIC and fouling in piping, piping components, and piping elements exposed to fuel oil. The applicant stated that loss of material due to general, pitting, and crevice corrosion and MIC for steel piping components and tanks exposed to fuel oil is managed by the Fuel Oil Chemistry Program. The Fuel Oil Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the Fuel Oil Chemistry Program to manage loss of material due to general, pitting, and crevice corrosion through examination of steel piping components and tanks exposed to fuel oil. Fouling is not identified as an aging effect for fuel oil.

SRP-LR Section 3.3.2.2.9 states that loss of material due to general, pitting, and crevice corrosion, MIC, and fouling may occur in steel piping, piping components, piping elements, and tanks exposed to fuel oil. The existing AMP relies on fuel oil chemistry programs to monitor and control fuel oil contamination to manage loss of material due to corrosion or fouling. Corrosion or fouling may occur at locations where contaminants accumulate. The effectiveness of fuel oil chemistry programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion, MIC, and fouling to verify the effectiveness of fuel oil chemistry programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff noted the applicant's statement in the LRA that fouling is not identified as an aging effect for fuel oil. However, the staff could find no basis for that statement provided in the LRA. The staff issued RAI 3.3.2.2.9.1-1 by letter dated July 15, 2008, asking the applicant to provide a basis for the statement that fouling is not identified as an aging effect for fuel oil.

In a letter dated August 15, 2008, the applicant responded to RAI 3.3.2.2.9.1-1 by providing the following response:

The quality of fuel oil is verified upon receipt and before it is delivered to the plant's fuel oil storage tanks, and introduced into the fuel oil system, to ensure that it does not contain contaminants, such as sediment, that could cause fouling. The potential for water contamination in the fuel oil during transfer and storage is, however, assumed. Therefore, the only foulants that would be expected in the fuel oil would be those that result from corrosion of steel piping and components, i.e., corrosion products. By managing loss of material due to general, pitting, crevice, and microbiologically induced corrosion, corrosion products will be controlled, and fouling will not occur. Therefore, fouling is not identified as an aging effect for fuel oil.

The staff reviewed the applicant's response and finds its acceptable because it provides a reasonable technical justification, based on fuel oil testing upon receipt, prior to

introducing the fuel oil into the fuel oil storage tanks, and on control of potential corrosion products, as to why fouling is not expected to occur for steel components exposed to a fuel oil environment. The issues raised in RAI 3.3.2.2.9.1-1 are resolved by the applicant's response.

The staff reviewed the applicant's Fuel Oil Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.11, found that the Fuel Oil Chemistry Program provides aging management for loss of material due to general, pitting, and crevice corrosion and MIC through monitoring and control of fuel oil contamination such as water or microbiological organisms. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components determined to be most susceptible to the aging effect(s) of interest and is capable of detecting loss of material due to general, pitting and crevice corrosion, and MIC, if it should occur in the selected components. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to general, pitting, and crevice corrosion, and MIC for steel piping, piping components, piping elements, and tanks exposed to fuel oil in the diesel fuel oil system and in the fire protection system to be acceptable.

(2) LRA Section 3.3.2.2.9 addresses loss of material due to general, pitting, crevice, MIC and fouling in piping, piping components, and piping elements exposed to lubricating oil. The applicant stated that loss of material due to general, pitting, and crevice corrosion and MIC for steel piping components exposed to lubricating oil is managed by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, including water. The Lubricating Oil Inspection will provide a verification of the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion and MIC through examination of steel piping components. The Lubricating Oil Analysis Program will also manage reduction in heat transfer due to fouling of heat exchanger tubes exposed to lubricating oil. For those heat exchangers within the scope of GL 89-13 for SSES, the Piping Corrosion Program is credited with managing fouling of heat exchanger tubes exposed to lubricating oil.

SRP-LR Section 3.3.2.2.9 states that loss of material due to general, pitting, and crevice corrosion, MIC, and fouling may occur in steel heat exchanger components exposed to lubricating oil. The existing AMP periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of lubricating oil programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff verified that only heat exchanger components that align to GALL AMR VII.H2-5 for the Control Structure Chilled Water system that are fabricated from steel materials are applicable to SSES.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.2.13 respectively. The staff reviewed the applicant's Lubricating Oil Analysis Program and determined that this program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion in steel piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its Lubricating Oil Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program to manage this aging effect. The applicant's AMPS are consistent with those recommended for aging management in SRP-LR Section 3.3.2.2.9, Item #2 and in GALL AMR Item VII.H2-5.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9 criteria. For those line items that apply to LRA Section 3.3.2.2.9, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.10 against the following criteria in SRP-LR Section 3.3.2.2.10:

(1) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in steel piping with elastomer lining or stainless steel cladding. The applicant stated that this aging effect is not applicable because elastomer linings are not credited for protection of metallic components, and are therefore, not subject to AMR. There are no steel with stainless steel cladding piping components that are exposed to treated water or treated borated water in the Auxiliary Systems for SSES.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in BWR and PWR steel piping with elastomer lining or stainless steel cladding exposed to treated water and treated borated water if the cladding or lining is degraded. The existing AMP monitors and controls reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities in crevices and with stagnant flow conditions may cause pitting or crevice corrosion; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

For applicable steel BWR piping, SRP-LR Section 3.3.2.2.10.1 invokes AMR Item 22 in Table 3 of the GALL Report, Volume 1, and GALL AMR Item VII.A4-12, applicable to the steel piping in the spent fuel pool cooling and cleanup (purification) systems designed with elastomeric linings or stainless steel cladding, where the elastomeric lining or stainless steel cladding has been determined to be degraded and the underlying steel material is exposed to treated water or borated treated water.

The staff verified that the LRA does not credit internal elastomeric liners in the components of the fuel pool cooling and cleanup system, or fuel pool auxiliaries for aging management. The staff also verified that the steel piping components in the SSES fuel pool cooling and cleanup systems and fuel pool auxiliaries do not include any internal stainless steel cladding. Based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding that the supplemental evaluation recommendations in SRP-LR Section 3.3.2.2.10.1 and in GALL AMR VII.A4-12 are not applicable to the LRA because the staff has verified that the applicant does not credit any elastomeric liner in the fuel pool cooling and cleanup systems for aging management and because the staff has verified that the fuel pool cooling and cleanup systems do not include any steel components that are lined with internal stainless steel cladding.

(2) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in piping, piping components, piping elements, and heat exchanger components. The applicant stated that loss of material due to pitting and crevice corrosion for stainless steel heat exchanger components exposed to treated water is managed by the Closed Cooling Water Chemistry Program. The Closed Cooling Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in stainless steel and aluminum piping, piping components, piping elements, and for stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The existing AMP monitors and controls reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities in crevices and with stagnant flow conditions may cause pitting or crevice corrosion; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.10.2 and the discussions in LRA Table 3.3.1, items 3.3.1 23 and 3.3.1 24, against the criteria in SRP-LR Section 3.3.2.2.10, item 2, which states that loss of material due to pitting and crevice corrosion may occur in stainless steel and aluminum piping, piping components, piping elements, and for stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The SRP-LR states that the existing AMP monitors and controls reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities in crevices and with stagnant flow conditions may cause pitting or crevice corrosion; therefore, the

effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of water chemistry control programs. The SRP-LR states that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff noted that the only AMR results referring to LRA Table 3.3.1, item 3.3.1 23, are for stainless steel heat exchanger components associated with diesel generator jacket water cooling. By letter dated August 12, 2008, and December 11, 2008, the applicant amended its LRA such that aluminum heat exchanger components associated with diesel generator lubricating oil cooling references LRA Table 3.3.1, item 3.3.1 24, in response to RAI B.2.14-2. For the stainless steel components, which are exposed to treated water in the closed cooling water system, as amended by its supplemental response to RAI B.2.14-2 by letter dated December 11, 2008, the applicant proposed to manage loss of material due to pitting and crevice corrosion using the Closed Cooling Water Chemistry Program and and the CPEI in lieu of the Water Chemistry and One-Time Inspection programs as recommended in the GALL Report.

The staff reviewed the applicant's Closed Cooling Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.7, found that the Closed Cooling Water Chemistry Program provides mitigation for the aging effect of loss of material due to corrosion by control of closed cooling water system chemistry consistent with applicable EPRI water chemistry guidelines. In addition, the Closed Cooling Water Chemistry Program includes monitoring for corrosion and is supplemented by a separate one-time inspection of other, representative areas serviced by the closed cooling water system. The one-time inspections are performed as part of the Chemistry Program Effectiveness Inspection, which the staff evaluates in SER Section 3.0.3.1.10. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage loss of material and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. Because the Closed Cooling Water Chemistry Program provides both mitigation of, and monitoring for pitting and crevice corrosion and the applicant will confirm the effectiveness of its chemistry program with a one-time inspection performed by the CPEI the staff finds use of the Closed Cooling Water Chemistry Program and the CPEI acceptable for managing the aging effect of loss of material due to pitting and crevice corrosion in stainless steel heat exchanger components exposed to treated water in the diesel generator jacket water cooling subsystem.

In LRA Table 3.3.1, Item 3.3.1-24, the applicant stated that the BWR Water Chemistry Program and the CPEI are credited to manage loss of material for stainless steel and aluminum components exposed to treated water. The applicant also stated that the BWR Water Chemistry Program, alone, is credited to manage loss of material for spent fuel storage racks made of aluminum. Furthermore, the applicant stated that the BWR Water Chemistry Program, alone, is credited to manage cracking of aluminum components exposed to treated water; however, that statement was deleted from the LRA as part of the applicant's response to RAI 3.3-2, discussed both near the end of this subsection and in SER Subsection 3.3.2.3.3.

The staff noted that for all stainless steel components where the AMR results are referenced to LRA Table 3.3.1, item 3.3.1-24, the aging effect is loss of material due to pitting and crevice corrosion and the applicant states that this aging effect will be managed by a combination of the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection. These results are consistent with AMR results in the GALL Report for the same material, environment and aging effect combination.

The staff noted that there are three AMR result lines referenced to LRA Table 3.3.1, item 3.3.1 24 where the material is aluminum. One of the lines is for aluminum accumulator (pistons) in the control rod drive hydraulic system exposed to treated water where the aging effect of loss of material is managed with a combination of the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection; this AMR result is consistent with the GALL Report. One of the lines is for aluminum spent fuel pool storage racks exposed to treated water where the aging effect of loss of material is managed with the BWR Water Chemistry Program, alone; this AMR result is not consistent with the GALL Report, but it is acceptable, as discussed below. One of the lines is for aluminum accumulator (pistons) in the control rod drive hydraulic system exposed to treated water where the applicant proposed to managed the aging effect of cracking with the BWR Water Chemistry Program, alone; however, in response to RAI 3.3-2 the applicant revised the this AMR result and the LRA as discussed below and in SER Subsection 3.3.2.2.3.

In the LRA the applicant provides plant-specific Note 0515 to explain use of the BWR Water Chemistry Program, alone, for managing loss of material from the aluminum spent fuel storage racks. In Note 0515 the applicant states that one-time inspection is not applicable for the spent fuel racks because the spent fuel pool does not contain areas of low or stagnant flow where pitting or crevice corrosion would likely occur. Note 0515 also refers to the GALL Report, Chapter VII.A2, where the Water Chemistry Program, alone, is credited with managing the aging effect of cracking due to stress corrosion cracking in stainless steel spent fuel storage racks. On the basis that there are no areas of low or stagnant flow in the spent fuel pool where contaminants causing corrosion might collect, and the applicant's proposed AMP is consistent with the AMP recommended in the GALL Report, Chapter VII.A2, item VII.A2-6, for similar stainless steel components in a spent fuel pool environment, the staff finds the applicant's use of the BWR Water Chemistry Program, alone, for managing loss of material from the aluminum spent fuel storage racks in a treated water environment to be acceptable.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to general, crevice and pitting corrosion. The staff reviewed the Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the applicant's CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to general, pitting or crevice corrosion, if it should occur in the selected components. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's use of the BWR Water Chemistry Program and the CPEI for managing the potential aging effect of loss

of material due to pitting and crevice corrosion for stainless steel and aluminum components exposed to treated water to be acceptable.

In LRA Table 3.3.2-3 (page 3.3-103), the applicant identified the aging effect of cracking as applicable for the aluminum pistons in the control rod drive accumulators which are exposed to an environment of treated water. The applicant proposed use of the BWR Water Chemistry Program, alone, for managing this aging effect in this component and cited generic Note H, indicating that the aging effect is not in the GALL Report for the component, material and environment combination. The staff issued RAI 3.3-2 by letter dated July 15, 2008, asking that the applicant provide further information to justify that the BWR Water Chemistry Program, alone, without an inspection to confirm program effectiveness, provides adequate aging management for this component. The RAI also asked the applicant to explain why the aging effect of cracking is referenced to LRA Table 3.3.1, item 3.3.1-24, where the aging effect is loss of material due to pitting and crevice corrosion.

In a letter dated August 15, 2008, the applicant responded to RAI 3.3-2 by providing the following response:

For the AMR results item listed on page 3.3-103 of the LRA for accumulator (pistons) made of aluminum in a treated water environment with an aging effect of cracking, Note H is the appropriate generic note because the aging effect, cracking, is not in the GALL Report for aluminum exposed to treated water. However, because the GALL Report Item VIII.E3-7 is for loss of material, the GALL Report Volume 2 item number and the Table 1 item number should have been identified as "N/A."

For this AMR result item, verification of the effectiveness of the BWR Water Chemistry Program is needed to confirm that cracking is not occurring in these components.

As part of the RAI response, the applicant revised the AMR result line in LRA Table 3.3.2 3, page 3.3-103. The revised AMR result line shows that for accumulators (pistons) made of aluminum in a treated water environment the aging effect of cracking will be managed by a combination of the BWR Water Chemistry Program and the Chemistry Program Effectiveness Inspection. Generic Note H continues to apply for this AMR result line, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The revised AMR result line no longer refers to GALL Volume 2 or LRA Table 1 items, and the staff's evaluation of this AMR result, as revised, is documented in SER Subsection 3.3.2.3.3.

The applicant responded to RAI B.2.14-2 by letter dated August 12, 2008, and supplemented its response by letter dated December 11, 2008. It is response and supplemental response the applicant amended its LRA such that the material-environment-aging effect combination of aluminum-treated water (internal)-loss of material referenced LRA Table 3.3.1, item 3.3.1 24. For the aluminum components, which are exposed to treated water in the closed cooling water system, the applicant proposed to manage loss of material due to pitting and crevice corrosion using a combination of the Closed Cooling Water Chemistry Program and the CPEI in lieu of the Water Chemistry and One-Time Inspection programs as recommended in the GALL Report.

The staff reviewed the applicant's Closed Cooling Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.7, found that the Closed Cooling Water Chemistry Program provides mitigation for the aging effect of loss of material due to corrosion by control of closed cooling water system chemistry consistent with applicable EPRI water chemistry guidelines. In addition, the Closed Cooling Water Chemistry Program includes monitoring for corrosion and is supplemented by a separate one-time inspection of other, representative areas serviced by the closed cooling water system. The one-time inspections are performed as part of the Chemistry Program Effectiveness Inspection, which the staff evaluates in SER Section 3.0.3.1.10. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage loss of material and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. Because the Closed Cooling Water Chemistry Program provides both mitigation of, and monitoring for pitting and crevice corrosion and the applicant will confirm the effectiveness of its chemistry program with a one-time inspection performed by the CPEI the staff finds use of the Closed Cooling Water Chemistry Program and the CPEI acceptable for managing the aging effect of loss of material due to pitting and crevice corrosion in aluminum heat exchanger components exposed to treated water in the diesel generator lubricating oil cooling subsystem.

(3) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in HVAC piping, piping components, and piping elements. The applicant stated that the Cooling Units Inspection is a one-time inspection that will detect and characterize loss of material due to pitting and crevice corrosion for copper alloy HVAC piping components in an external environment with potential for wetting.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in copper alloy heating, ventilation, and air conditioning (HVAC) piping, piping components, and piping elements exposed to condensation (external). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The GALL report, under Items VII.F1-16, VII.F2-14, VII.F3-16 and VII.F4-12 recommends that a plant-specific program be credited to manage this aging effect for copper alloy HVAC piping, piping components and piping elements in the Auxiliary Systems.

The staff verified that only heat exchanger components, piping and piping components and valve bodies that align to GALL AMRs VII.F1-16, VII.F2-14 and VII.F4-12 for the Domestic Water System, Emergency Service Water System, Fire Protection System, Raw Water Treatment System, Reactor Building Chilled Water System, RHR Service Water System, Sampling System, Service Water System, Control Structure Chilled Water System and Diesel Generator System that are fabricated from copper alloy materials are applicable to SSES that credit the System Walkdown Program.

The staff reviewed the applicant's System Walkdown Program and its evaluation is documented in SER Sections 3.0.3.1.9. The staff determined that the System Walkdown Program which includes periodic visual inspections performed during system walkdowns, are adequate to manage loss of material due to pitting and crevice

corrosion for copper alloy HVAC piping, piping components, and piping elements exposed to indoor and outdoor air environment with the potential for wetting addressed by this AMR. The staff finds that the System Walkdown Program performs periodic visual inspections of external surfaces during periodic system to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to pitting and crevice corrosion for copper alloy HVAC piping, piping components and piping elements exposed condensation on the external surface.

The staff reviewed the applicant's Cooling Units Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Cooling Units Inspection Program is documented in SER Section 3.0.3.1.11. Because the Cooling Units Inspection is performed at selected susceptible locations, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Cooling Units Inspection Program will adequately manage the aging effects of loss of material in this wetted environment.

(4) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in piping, piping components, and piping elements exposed to lubricating oil. The applicant stated that loss of material due to pitting and crevice corrosion for copper alloy piping components exposed to lubricating oil is managed by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, including water. The Lubricating Oil Inspection will provide a verification of the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to pitting and crevice corrosion through examination of copper alloy piping components

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing AMP periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of lubricating oil programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff verified that only piping, piping components and elements that align to GALL AMR VII.C2-5 and VII.H2-10 for the Fire Protection, Control Structure Chilled Water and Diesel Generator Lubricating Oil and NSAS Component systems that are fabricated from copper alloy materials are applicable to SSES.

The staff reviewed the applicant's Lubricating Oil Analysis Program and determined that this program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of

material due to pitting and crevice corrosion for copper alloy piping, piping components, and piping elements exposed to lubricating oil.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.2.13 respectively. The staff verified that the applicant has credited its Lubricating Oil Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program to manage this aging effect. The applicant's AMPS are consistent with those recommended for aging management in SRP-LR Section 3.3.2.2.10, Item #4 and in GALL AMR Item VII.C2-5 and VII.H2-10.

Based on the program identified above, the staff concludes that the applicant's program meet SRP-LR Section 3.2.2.2.10 Item (4) criteria and therefore the applicant's AMRs are consistent with those under GALL Report Item VII.C2-5 and VII.H2-10. For those line items that apply to LRA Section 3.2.2.2.10 Item #4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

During its review, the staff noted that the applicant identified in LRA Table 3.3.2-4, Control Structure Chilled Water System, a Type-2 line item that utilized a standard Note I and plant-specific Note 0310, claiming that the aging effect, loss of material due to pitting and crevice corrosion, is not applicable to SSES for this component, material and environment combination. The applicant states that this Type-2 item is not applicable to SSES because this tubing that is exposed to lubricating oil internally is made of copper with less than 15% zinc, therefore is not susceptible to this aging effect and environment combination. The staff verified in the GALL Report, Chapter IX.C that components made of copper alloy with less than 15% zinc are resistant to loss of material due to pitting and crevice corrosion. Based on this assessment, the staff concludes that this Type-2 item in LRA Table 3.3.2-4 is not applicable to SSES.

(5) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in HVAC piping, piping components, and piping elements and ducting. The applicant stated that the Cooling Units Inspection is a one-time inspection credited with detecting and characterizing the condition of aluminum and stainless steel HVAC components exposed to condensation. The System Walkdown Program is credited for managing loss of material due to pitting and crevice corrosion for the external surfaces of stainless steel HVAC components exposed to condensation.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The GALL report, under Item VII.F1-1, VII.F2-1, VII.F3-1, VII.F1-14, VII.F2-12, VII.F3-14 and VII.F4-10 recommends that a plant-specific program be credited to this aging effect for stainless steel ducting and components and piping elements in the Auxiliary Systems.

The staff verified that only ducting and components that align to GALL AMRs VII.F1-1, VII.F2-1 and VII.F3-1 for the Emergency Service Water System, Fire Protection System, Fuel Pool Cooling System, Primary Containment Atmosphere Circulation System, Process and Area Radiation Monitoring System, Reactor Building Chilled Water and HVAC System, RHR Service Water System, Sampling System and Control Structure Chilled Water System that are fabricated from stainless steel and steel materials are applicable to SSES that credit the Systems Walkdown Program.

The staff reviewed the applicant's System Walkdown Program and its evaluation is documented in SER Sections 3.0.3.1.9. The staff determined that the System Walkdown Program which includes periodic visual inspections performed during system walkdowns, are adequate to manage loss of material due to pitting and crevice corrosion for stainless steel and steel ducting and components exposed to indoor and outdoor air environment with the potential for wetting addressed by this AMR. The staff finds that the System Walkdown Program performs periodic visual inspections of external surfaces during periodic system to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to pitting and crevice corrosion for stainless steel and steel ducting and components exposed indoor and outdoor air with the potential for wetting on the external surface.

Subsection 3.3.2.2.10.5 is referenced in the LRA Table 3.3.1 for line item 3.3.1-27. In the discussion column of Table 3.3.1, item 3.3.1-27, the LRA states that the Cooling Units Inspection will also detect and characterize cracking of aluminum HVAC cooling unit fins, for which Note H is used. However, a review of Table 2s did not identify a line item where this is identified. The staff issued RAI 3.3.1-6 by letter dated July 9, 2008, to request the applicant to clarify where in Table 2s the Cooling Units Inspection is credited for managing cracking of aluminum HVAC cooling unit fins.

In its letter dated August 8, 2008, the applicant responded to RAI 3.3.1-6 by stating that the Cooling Unit Inspection Program is not credited for managing cracking of aluminum HVAC cooling unit fins. The applicant revised LRA Table 3.3.1, item 3.3.1-27 and the associated LRA Section 3.3.2.2.10.5 to remove the statement crediting the Cooling Unit Inspection Program in conjunction with cracking of aluminum HVAC cooling unit fins.

The staff reviewed the applicant's response and the LRA revision. With the removal of the statement crediting the Cooling Unit Inspection Program for cracking of aluminum HVAC cooling fins, Table 3.3.1,. Item 3.3.1-27 and Section 3.3.2.2.10.5 are consistent with Table 2s, where cracking of aluminum fins is not addressed and there is no discrepancy between Table 1 and Table 2. On this basis, the staff finds the response acceptable.

The staff reviewed the Cooling Units Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Cooling Units Inspection Program is documented in SER Section 3.0.3.1.11. Because the Cooling Units Inspection is performed at selected susceptible locations, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Cooling Units Inspection Program will adequately manage the aging effects of loss of material in this wetted environment.

In the discussion column of Table 3.3.1, item 3.3.1-27, the LRA states that the System Walkdown Program, the Cooling Units Inspection, and the Supplemental Piping/Tank Inspection are credited to manage loss of material and references Section 3.3.2.2.10.5 for further evaluation. However, Section 3.3.2.2.10.5 does not address the Supplemental Piping/Tank Inspection. The staff issued RAI 3.3.2.2.10.5-1 by letter dated July 9, 2008, to request the applicant to resolve this discrepancy.

In its letter dated August 8, 2008, the applicant responded to RAI 3.3.2.2.10.5-1 by amending the LRA to add the following in LRA Section 3.3.2.2.10.5

> The Supplemental Piping/Tank Inspection is a one-time inspection credited with detecting and characterizing the condition of stainless steel components that are exposed to moist air, particularly the aggressive alternate wet/dry environment that exists at air-water interfaces.

On the basis that the applicant amended the LRA to resolve the discrepancy between Table 3.3.1, item 3.3.1-27 discussion column and this Subsection, the staff finds the response acceptable. The Supplementary Piping/Tank Inspection Program is discussed below.

In Table 3.3.2-14, Fuel Pool Cooling System, item 3.3.1-27 is referenced on three line items, stainless steel piping (in two environments) and stainless steel skimmer surge tanks. Table 3.3.2-14 also references for these three line items footnote 0303, which states that loss of material is due to crevice and/or pitting corrosion caused by alternate wetting and drying, not condensation, at the air-water interface. The applicant has chosen to apply SRP-LR Section 3.3.2.2.10.5 to these three line items, even though the stainless piping is in fuel pool cooling system with an environment similar to ventilation.

The applicant referenced GALL Report Volume 2, items VII.F1-1. The staff noted that where the GALL Report recommends a plant-specific aging management program, the applicant proposed using the Supplementary Piping/Tank Inspection Program.

The staff reviewed the Supplementary Piping/Tank Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection is performed at very specific locations of air/water interface, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

(6) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in the fire protection system. The applicant stated that this aging effect is not applicable because the components are open to local ambient air conditions such that condensation will not occur and are not subject to continuous wetting or alternate wetting and drying that would constitute an aggressive environment.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. The GALL Report recommends

further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff reviewed the GALL Report and noted that for copper alloy components in air-indoor environment, line item V.F-3 identifies no aging effect and no aging management program is required. On the basis that these copper alloy fire protection components are open to the atmosphere and do not see continuous wetting or alternate wetting and drying, the staff finds that consistent with the GALL Report, loss of material due to pitting and crevice corrosion is not an aging effect requiring management.

(7) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to soil. The applicant stated that this aging effect is not applicable to auxiliary systems and is evaluated in steam and power conversion systems.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, and piping elements exposed to soil.

LRA Table 3.3.1 states that there are no SSES components comparable to LRA item number 3.3.1-29. The staff verified that there are no components that are comparable. The only stainless steel piping subject to AMR for SSES that is exposed to soil is located in the Condensate Transfer and Storage System and is evaluated in the Steam and Power Conversion group for LRA item number 3.4.1-17. The staff's evaluation of the stainless steel piping exposed to soil in the Condensate Transfer and Storage System is documented in SER Section 3.4.2.2.7.2.

(8) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in BWR SLC system. The applicant stated that loss of material due to pitting and crevice corrosion for stainless steel piping components exposed to sodium pentaborate solution is managed by the BWR Water Chemistry Program. The BWR Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the BWR Water Chemistry Program to manage loss of material due to pitting and crevice corrosion through examination of stainless steel piping components exposed to sodium pentaborate solution.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, and piping elements of the BWR SLC system exposed to sodium pentaborate solution. The existing AMP monitors and controls water chemistry to manage the aging effects of loss of material due to pitting and crevice corrosion. However, high concentrations of impurities in crevices and with stagnant flow conditions may cause loss of material due to pitting and crevice corrosion; therefore, the GALL Report recommends that the effectiveness of water chemistry control programs should be verified to ensure that this aging does not occur. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, determined that the BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to pitting and crevice corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to pitting or crevice corrosion, if it should occur in the selected components. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to pitting or crevice corrosion in stainless steel piping components exposed to sodium pentaborate solution in the standby liquid control system to be acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10 criteria. For those line items that apply to LRA Section 3.3.2.2.10, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

The staff reviewed LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11.

LRA Section 3.3.2.2.11 addresses loss of material due to pitting, crevice, and galvanic corrosion. The applicant stated that loss of material due to pitting, crevice, and galvanic corrosion for copper alloy piping components exposed to treated water is managed by the BWR Water Chemistry Program. The BWR Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the BWR Water Chemistry Program to manage loss of material due to pitting, crevice, and galvanic corrosion through examination of copper alloy piping components exposed to treated water.

SRP-LR Section 3.3.2.2.11 states that loss of material due to pitting, crevice, and galvanic corrosion may occur in copper alloy piping, piping components, and piping elements exposed to treated water. Therefore, the GALL Report recommends that the effectiveness of water chemistry control programs should be verified to ensure that this aging does not occur. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, determined that the BWR Water Chemistry Program provides mitigation for the aging effect of loss of material due to pitting, crevice and galvanic corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes

provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to pitting, crevice or galvanic corrosion, if it should occur in the selected components. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to pitting, crevice or galvanic corrosion in copper alloy piping components exposed to treated water in the reactor water cleanup system and in the control rod drive hydraulic system to be acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.11 criteria. For those line items that apply to LRA Section 3.3.2.2.11, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.3.2.2.12 against the following criteria in SRP-LR Section 3.3.2.2.12:

(1) LRA Section 3.3.2.2.12 addresses loss of material due to pitting, crevice, and MIC in piping, piping components, and piping elements exposed to fuel oil. The applicant stated that there are no aluminum piping components exposed to fuel oil that are subject to AMR for SSES. Loss of material due to pitting and crevice corrosion and MIC for stainless steel and copper alloy piping components exposed to fuel oil is managed by the Fuel Oil Chemistry Program. The Fuel Oil Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the Fuel Oil Chemistry Program to manage loss of material due to pitting and crevice corrosion and MIC through examination of stainless steel and copper alloy piping components exposed to fuel oil. Though not credited, the Fire Protection Program provides indirect confirmation of whether degradation of these components has occurred, and that the component intended function is maintained.

SRP-LR Section 3.3.2.2.12 states that loss of material due to pitting and crevice corrosion, and MIC may occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. The existing AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion; however, corrosion may occur at locations where contaminants accumulate and the effectiveness of fuel oil chemistry control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the fuel oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Fuel Oil Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.1, found that the Fuel Oil Chemistry Program provides aging management for loss of material due to pitting and crevice corrosion and MIC through monitoring and control of fuel oil contamination such as water or microbiological organisms. The staff reviewed the applicant's Chemistry

Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components determined to be most susceptible to the aging effect(s) of interest and is capable of detecting loss of material due to pitting or crevice corrosion or MIC, if it should occur in the selected components. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to pitting and crevice corrosion and MIC for stainless steel or copper alloy piping components exposed to fuel oil in the diesel fuel oil system and in the fire protection system to be acceptable.

(2) LRA Section 3.3.2.2.12 addresses loss of material due to pitting, crevice, and MIC in piping, piping components, and piping elements exposed to lubricating oil. The applicant stated that loss of material due to pitting and crevice corrosion and MIC for stainless steel piping components exposed to lubricating oil is managed by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, including water. The Lubricating Oil Inspection will provide a verification of the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to pitting and crevice corrosion and MIC through examination of stainless steel piping components.

SRP-LR Section 3.3.2.2.12 states that loss of material due to pitting, crevice, and MIC may occur in stainless steel piping, piping components, and piping elements exposed to lubricating oil. The existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of lubricating oil programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff verified that only piping, piping components and elements that align to GALL AMR VII.H2-17 for the Diesel Generator Lubricating Oil system that are fabricated from stainless steel materials are applicable to SSES.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.2.13 respectively. The staff reviewed the applicant's Lubricating Oil Analysis Program and determined that this program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion in stainless steel piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its Lubricating Oil Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program to manage this aging effect. The applicant's AMPS are consistent with

those recommended for aging management in SRP-LR Section 3.3.2.2.12, Item #2 and in GALL AMR Item VII.H2-17.

Based on the program identified above, the staff concludes that the applicant's program meet SRP-LR Section 3.3.2.2.12, Item #2 criteria and therefore the applicant's AMRs are consistent with those under GALL Report Item VII.H2-17. For those line items that apply to LRA Section 3.3.2.2.12, Item #2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12 criteria. For those line items that apply to LRA Section 3.3.2.2.12, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.13 Loss of Material Due to Wear

The staff reviewed LRA Section 3.3.2.2.13 against the criteria in SRP-LR Section 3.3.2.2.13.

LRA Section 3.3.2.2.13 addresses loss of material due to wear. The applicant stated that this aging effect is not applicable because wear only occurs during the performance of an active function, as a result of improper design, application or operation, or to a very small degree with insignificant consequences.

SRP-LR Section 3.3.2.2.13 states that loss of material due to wear may occur in the elastomer seals and components exposed to air - indoor uncontrolled (internal or external). The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

For applicable steel BWR piping, SRP-LR Section 3.3.2.2.13 invokes AMR Item 34 in Table 3 of the GALL Report, Volume 1, and GALL AMR Item VII.F1-5, VII.F1-6, VII.F2-5, VII.F2-6, VII.F3-5, VII.F3-6, VII.F4-4 and VII.F4-5, as applicable to the management of loss of material due to wear in elastomeric seals and components in control room area ventilation, auxiliary and radwaste area ventilation, primary containment heating and ventilation, and diesel generator building ventilation systems under internal and external exposure to uncontrolled indoor air.

The staff reviewed the information in LRA Section 3.3.2.2.13 against the staff's recommendations in SRP-LR Section 3.3.2.2.13 and in GALL AMR items Item VII.F1-5, VII.F1-6, VII.F2-5, VII.F2-6, VII.F3-5, VII.F3-6, VII.F4-4 and VII.F4-5, as applicable to the management of loss of material due to wear in elastomeric seals and components in control room area ventilation, auxiliary and radwaste area ventilation, primary containment heating and ventilation, and diesel generator building ventilation systems under internal and external exposure to uncontrolled indoor air.

The staff confirmed that the scope of the applicant's application includes the following AMR tables for auxiliary HVAC systems:

- Table 3.3.2-5, Aging Management Results for Control Structure HVAC Systems
- Table 3.3.2-8, Diesel Generator Buildings HVAC Systems
- Table 3.3.2-12, ESSW Pumphouse HVAC System
- Table 3.3.2-16, Primary Containment Atmosphere Circulation System
- Tabl3 3.3.2-23, Reactor Building HVAC System

The staff noted that these AMR Tables did not include any AMRs on management of loss of material due to wear in elastomeric HVAC seals and components or that were aligned to AMR Item 34 in Table 3 of the GALL Report, Volume 1, or to GALL AMR Item VII.F1-5, VII.F1-6, VII.F2-5, VII.F2-6, VII.F3-5, VII.F3-6, VII.F4-4 or VII.F4-5. The staff also noted that the applicant's basis for concluding that loss of material due to wear was based on a misplaced conclusion. Specifically, the staff noted that the applicant based its conclusion that loss of material due to wear was not an AERM on the fact that wear is an active loss of material mechanism and not on the fact that the elastomeric HVAC seals and components for which wear is plausible are active components or components that are replaced on a qualified or specified frequency. The staff noted that the fact that wear is an active loss of material mechanism did not provide any logical basis for concluding that wear was not plausible aging mechanisms for any passive, long-lived elastomeric seals or components in these HVAC systems.

In RAI 3.3.2.2.13-1, by letter dated July 23, 2008, the staff informed the applicant that the fact that wear is an active aging mechanism does not provide a valid or acceptable basis for concluding that the passive long-lived elastomeric HVAC seals or components are not subject to potential loss of material due to wear. In this RAI, the staff asked the applicant to provide a valid basis why loss of material due to wear is not considered to be an AERM for the elastomeric seals and components in the control structure HVAC systems, diesel generator building HVAC systems, ESSW pumphouse HVAC system, primary containment atmosphere circulation system, or reactor building HVAC system.

In its letter dated August 27, 2008, in response to RAI 3.3.2.2.13-1, the applicant provided the following bases, that have been documented in industry guidance on the aging of elastomers, upon which it concluded that loss of material due to wear is not an aging effect requiring management for elastomer seals and components:

- the elastomer seals and components were selected based on their suitability for the service in which they would be applied, i.e., they were properly designed;
- the elastomer seals and components were properly applied and installed, i.e., within allowable pre-compression and offset limits, thus preventing significant relative motion between the contacting surfaces; and,
- the systems in which the elastomer seals and components are installed are operated in accordance with procedures that have been developed based on standard industry good practices, thus preventing excessive vibration and unintended component movements

Flexible connections are used in applications where some movement between the joined piping, ductwork, and components is expected to occur. However, as indicated above, the flexible connections are securely attached to the joined components such that there is no relative movement between the connection of the flexible connection and the component. The flexible

connection is designed to accommodate relative movements, however proper design and installation ensures that the flexible connection does not make contact with itself or with other nearby components

Therefore, the applicant concluded that there is no relative motion expected between contacting surfaces and wear is not an aging effect requiring management.

The staff reviewed the applicant response and reviewed the definition of wear in the GALL Report Section IX.F. The GALL Report defines wear as the removal of surface layers due to relative motion between two surfaces or under the influence of hard abrasive powder. The GALL Report further states that wear occurs in parts that experience intermittent relative motion or frequent manipulation. The staff determined that use of flexible connections in systems that experience vibration minimizes relative motion of the piping system, thereby minimizing wear. These systems are designed to account for relative motion and therefore, the staff finds that for elastomeric seals and components in control room area ventilation, auxiliary and radwaste area ventilation, primary containment heating and ventilation, and diesel generator building ventilation systems under internal and external exposure to uncontrolled indoor air do not experience loss of material due to wear. On this basis the staff finds the applicant response acceptable.

Therefore, the staff concludes that loss of material due to wear is not an aging effect requiring management for elastomer seals and components exposed to air - indoor uncontrolled (internal or external).

Based on the above, the staff concludes SRP-LR Section 3.3.2.2.13 criteria are not applicable.

3.3.2.2.14 Loss of Material Due to Cladding Breach

The staff reviewed LRA Section 3.3.2.2.14 against the criteria in SRP-LR Section 3.3.2.2.14.

LRA Section 3.3.2.2.14 addresses loss of material due to cladding breach. The applicant stated that this aging effect is not applicable because SSES is a BWR.

SRP-LR Section 3.3.2.2.14 states that loss of material due to cladding breach may occur in PWR steel charging pump casings with stainless steel cladding exposed to treated borated water.

The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES has no steel with stainless steel cladding pump casing exposed to treated borated water, an environment only exist in PWR. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

Based on the above, the staff concludes SRP-LR Section 3.3.2.2.14 criteria are not applicable.

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.3.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.3.2-1 through 3.3.2-34, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.3.2-1 through 3.3.2-34, the applicant indicated, via notes F through J that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.3.2.3.1 Aging Management Review Results - Building Drains Nonradioactive System – LRA Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the building drains nonradioactive system component groups.

In LRA Table 3.3.2-1, the applicant proposed to manage loss of material due for cast iron, carbon steel and copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting loss of material and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-1, the applicant proposed to manage loss of material due to selective leaching for cast iron and copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. The staff noted that the GALL Report recommends the use of the Selective Leaching Program for the same combination of material/environment/aging effect in items VII.C1-10, and VII.C1-11 for different systems. On the basis that the applicant will be performing a combination of a visual inspection and hardness test for these components and these AMR material/environment/aging effect combination is consistent with the GALL AMR Item VII.C1-10 and VII.C1-11, for copper alloy and cast iron respectively, the staff finds the AMR results for this line item acceptable.

LRA Table 3.3.2-1 summarizes the results of AMRs for the Building Drains Nonradioactive System piping and piping components constructed out of copper alloy and exposed to indoor air (external). The applicant proposed no aging effect and therefore that no AMP is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for this component and material. The staff also agrees that there will not be any aging mechanism for this material/environment combination and that no AMP is required. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure as cited in Metals Handbook, Volume 13, "Corrosion" (American Society for Metals International, 1987).

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.2 Aging Management Review Results - Containment Instrument Gas System – LRA Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the containment instrument gas system component groups.

In LRA Table 3.3.2-2, the applicant proposed to manage cracking of copper alloy for heat exchanger shells in the Containment Instrument Gas System exposed to an internal environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the Closed Cooling Water Program to manage cracking for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination. The Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing cracking for copper and copper alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

In LRA Table 3.3.2-2, the applicant proposed to manage loss of material due for carbon steel material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting loss of material and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

LRA Table 3.3.2-2 summarizes the results of AMRs for the Containment Instrument Gas System copper alloy (brass) heat exchanger shells for compressors exposed to indoor air (external). The applicant proposed no aging effect and therefore that no AMP is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for this component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination and that no AMP is required because copper alloy in air-indoor internal environment has no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure which is much more severe than indoor air environment as cited in Metals Handbook, Volume 13, "Corrosion" (American Society for Metals International, 1987).

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.3 Aging Management Review Results - Control Rod Drive Hydraulic System – LRA Table 3.3.2-3

The staff reviewed LRA Table 3.3.2-3, which summarizes the results of AMR evaluations for the CRD hydraulic system component groups.

In LRA Tables 3.3.2-3 the applicant proposed to manage cracking in copper alloy piping and piping components, and in aluminum accumulator (pistons), in an environment of treated water by using the BWR Water Chemistry Program. The applicant cited generic Note H for these AMR results, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. In a letter dated July 15, 2008, the staff issued RAI 3.2-3, applicable for the copper components and for similar AMR results in LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-25, and 3.4.2 3. In the same letter, the staff also issued RAI 3.3 2, applicable for the aluminum components. The RAIs asked the applicant to provide a technical justification as to why an inspection program, such as the CPEI is not needed to confirm that the BWR Water Chemistry Program is effective in preventing the aging effect.

In a letter dated August 15, 2008, the applicant responded to RAI 3.2-3 and 3.3-2 by providing the following responses:

RAI 3.2-3 Response:
For the five AMR results lines listed in LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3, where the material is copper alloy, the environment is treated water (internal), and the aging effect is cracking, verification of the effectiveness of the BWR Water Chemistry Program is needed. The CPEI will provide confirmation of the effectiveness of this program in managing the effects of aging, including cracking in susceptible materials. LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3 are revised to reflect these results.

RAI 3.3-2 Response:

For the AMR results item listed on page 3.3-103 of the LRA for accumulator (pistons) made of aluminum in a treated water environment with an aging effect of cracking, verification of the effectiveness of the BWR Water Chemistry Program is needed. The CPEI will provide confirmation of the effectiveness of this program in managing the effects of aging, including cracking of susceptible materials. The affected LRA Tables are revised.

The staff reviewed the applicant's response and the associated LRA changes. The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of cracking due to stress corrosion cracking. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and uses examination techniques that are capable of detecting cracking, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection of the aging effect if it should occur, the staff finds the applicant's proposed AMPs for managing the potential aging effect of cracking in copper alloy piping and piping components and in aluminum accumulator (pistons) exposed to treated water in the control rod drive hydraulic system to be acceptable. On this basis, the staff finds that the issues raised in RAIs 3.2 3 and 3.3-2 are resolved by the applicant's LRA changes.

LRA Table 3.3.2-3 summarizes the results of AMRs for control rod drive hydraulics system piping and piping components constructed using copper alloy exposed to indoor air (external). The applicant proposed that there is no aging effect for the material environment combination and that no AMR is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for the component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination, and that no AMP is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.4 Aging Management Review Results - Control Structure Chilled Water System – LRA Table 3.3.2-4

The staff reviewed LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the control structure chilled water system component groups.

In LRA Table 3.3.2-4, the applicant proposed to manage cracking of copper alloy for chiller evaporator and oil cooler tubes and plugs in the Control Structure Chilled Water System

exposed to an internal and external environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the Closed Cooling Water Program to manage cracking for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination. The Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing cracking for copper and copper alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

In LRA Table 3.3.2-4, the applicant proposed to manage reduction of heat transfer for copper alloy greater than 15 percent zinc material for chiller oil cooler tubes exposed to an external environment of lubricating oil using the Lubricating Oil Analysis Program, supplemented by the Lubricating Oil Inspection. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, environment and material combination.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.2.13, respectively. The Lubricating Oil Analysis Program is an existing program, that when enhanced, will include sample locations from the control structure chiller, and will properly monitor relevant conditions, such as particulate and water concentrations, viscosity, neutralization number and flash point, that can lead to start and spread of loss of material or reduction in heat transfer capability. The program's monitoring is based on manufacturer's recommendations, equipment importance and accessibility and ASTM standards for lubricating oils. The applicant will supplement this program with the Lubricating Oil Inspection, which will provide direct evidence as to whether and to what extent reduction of heat transfer has occurred, thus providing evidence of the effectiveness of the Lubricating Oil Analysis Program. The staff finds lubricating oil in contact with the control structure chiller components will be properly monitored and the aging effect of reduction in heat transfer of copper alloy greater than 15 percent zinc exposed to an external environment of lube oil will be adequately managed by these programs.

In LRA Table 3.3.2-4, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for valve bodies exposed to an external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

In Table 3.3.2-4, the LRA states that for glass skid-mounted sight glass components under internal exposure to an air-gas environment, there are no aging effects identified and no aging management program is required. The staff found that the plant-specific AMR for the exposure of the glass skid-mounted sight glass components under internal exposure to an air-gas environment (an uncontrolled air environment) was consistent with the AMR in GALL Report Item VII.J-08 for exposure of glass components to uncontrolled indoor air environments. Based on this review, the staff finds that the applicant has provided a valid basis for concluding that there are not any AERMs for the glass skid-mounted sight glass components because the applicant's AMR is consistent with GALL Report Item VII.J-08.

LRA Table 3.3.2-4 summarizes the results of AMRs for the Control Structure Chilled Water System copper tubing (skid mounted) exposed to lubricating oil (internal). The applicant proposed no aging effect and therefore that no AMP is required.

The applicant has indicated that generic Note I is applicable for these items. Generic Note I is "Aging effect in NUREG-1801 for this component, material, and environment is not applicable." Plant-specific Note 310 stated that "copper contains less than 15% zinc, and therefore is not susceptible to loss of material in this environment." The staff agrees that there will not be an aging mechanism for this material/environment combination for copper tubing containing less than 15% Zn and that no AMP is required. The GALL Report line items V EP-11-I, VII AP-10-J and VIII SP-7-I have copper alloy exposed to lubricating oil with no aging effect and no aging management program required. The same will be true for the Control Structure Chilled Water System copper tubing because it has the same material/environment combination as the GALL Report Chapter V and VII material/environment and will have the same aging effect and aging management program.

LRA Table 3.3.2-4 summarizes the results of AMRs for the Control Structure Chilled Water System sight gauges (skid mounted) constructed from glass and exposed to air-gas (internal). The applicant proposed no aging effect and therefore that no AMP is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for this component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination and that no AMP is required. This conclusion is based on the fact that there have been no aging effects observed for glass components in this environment. Ref: Handbook of Glass Properties, N. P. Bansal and R. H. Doremua, Academic Press 1986, pg. 646.

The staff reviewed LRA Table 3.3.2-4 which summarizes the results of AMRs for the Control Structure Chilled Water System copper alloy (copper-nickel or brass) chiller tube plugs. The applicant proposed that this system meets the definitions given above and therefore the environment, aging effect requiring management, and AMR should be classified as not applicable. The staff agrees with this proposal because these components do not have an internal surface because they are solid and therefore, there will not be an aging effect requiring an AMP.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.5 Aging Management Review Results - Control Structure HVAC Systems – LRA Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the control structure HVAC systems component groups.

In LRA Table 3.3.2-5, the applicant proposed to manage cracking of copper alloy for heating and ventilation unit structure channels and cooling unit control and computer room channels in the Control Structure HVAC System exposed to an internal and external environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the Closed Cooling Water Program to manage cracking for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination. The Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing cracking for

copper and copper alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

In LRA Table 3.3.2-5, the applicant proposed to manage loss of material due for carbon steel material for piping and piping components and humidifier housings exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting loss of material and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-5, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for the computer room floor cooling unit, control room floor cooling unit and the control structure heating and ventilation unit exposed to an external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection." By letter dated July 25, 2008, the applicant amended its LRA to credit AMP B.2.29 for aging management of these AMR line items.

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicant's proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of

these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

LRA Table 3.3.2-5 summarizes the results of AMRs for the Control Structure HVAC System cooling unit, cooling coils, copper alloy (brass), copper tubing, flow element valve bodies, computer and control room floor cooling coils, and aluminum flow elements exposed to ventilation (internal and external). The applicant proposed no aging effect and therefore that no AMP is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for this component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination and that no AMP is required. The staff noted aluminum has an excellent resistance to corrosion when exposed to a humid air (outdoor environment). In most environments the aluminum oxide film bonds strongly to its surface and if damaged, reforms immediately. On a surface freshly abraded and then exposed to air, the oxide film is only 5 to 10 nanometers thick but highly effective in protecting the aluminum from corrosion. Therefore, aluminum exposed to an outdoor air environment has no applicable aging effect. (M. G. Fontana, "Corrosion Engineering, Third Edition, McGraw-Hill, 1986.) Copper alloy in an air-indoor internal environment has no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure as cited in Metals Handbook, Volume 13, "Corrosion" (American Society for Metals International, 1987).

The staff reviewed LRA Table 3.3.2-5 which summarizes the results for the Control Structure HVAC System air strengtheners and fins constructed out of aluminum. The applicant proposed that this system meets the definitions given above and therefore the environment, aging effect requiring management, and AMR should be classified as not applicable. The staff agrees with this proposal because these components do not have an internal surface because they are solid and therefore, there will not be an aging effect requiring an AMP.

In LRA Table 3.3.2-5, the applicant proposed to manage reduction of heat transfer of aluminum cooling unit fins in an external environment of ventilation by using the Cooling Units Inspection Program. The applicant referenced footnote "H" for this line item indicating that aging effect is not in the GALL Report for this component, material and environment combination.

The staff noted the Cooling Unit Inspection Program will detect and characterize the condition of cooling unit components that are exposed to a ventilation environment, and provides direct evidence as to whether and to what extent, reduction of heat transfer has occurred, or is likely to occur that could result in a loss of intended function. In its letter dated July 25, 2008, the applicant responded to RAI B.2.23-2 stating that visual inspection (VT-3 or equivalent) techniques will be used to determine whether reduction in heat transfer is occurring. The applicant also stated that the specific inspection technique will be determined prior to the inspection activities and will be consistent with the recommendations in GALL AMP XI.M32. The staff's evaluation of the Cooling Units Inspection Program is documented in SER Section 3.0.3.1.11. Because the Cooling Units Inspection Program performs visual inspection to determine if any fouling has occurred that could cause reduction of heat transfer, and on the basis that the visual inspection technique will be consistent with the recommendation in GALL AMP XI.M32, the staff finds the Cooling Units Inspection Program will adequately manage the

aging effect of reduction of heat transfer in cooling unit components exposed to a ventilation environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.6 Aging Management Review Results - Cooling Tower System – LRA Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the cooling tower system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-6 are consistent with the GALL Report.

3.3.2.3.7 Aging Management Review Results - Diesel Fuel Oil System – LRA Table 3.3.2-7

The staff reviewed LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the diesel fuel oil system component groups.

In LRA Table 3.3.2-7 the applicant proposed to manage cracking in copper alloy level gauges, orifices, tubing, and valve bodies in an environment of fuel oil using the Fuel Oil Chemistry Program, alone. The staff noted that the Fuel Oil Chemistry Program does not include a component inspection activity and issued RAI 3.3-5 by letter dated July 15, 2008, asking the applicant to explain how effectiveness of the Fuel Oil Chemistry Program will be confirmed for these components.

In a letter dated August 15, 2008, the applicant responded to RAI 3.3-5 by providing the following response:

For the seven AMR result lines listed in LRA Table 3.3.2-7, where the aging effect is cracking and the AMP is designated as the Fuel Oil Chemistry Program, verification of the effectiveness of the Fuel Oil Chemistry Program is needed to confirm that cracking is not occurring in these components.

The CPEI will detect and characterize the condition of materials managed by the Fuel Oil Chemistry Program. Implementation of the CPEI will provide confirmation of the effectiveness of this program in managing the effects of aging, including cracking of the susceptible materials.

The applicant revised the seven (7) affected lines in LRA Table 3.3.2-7 to show that the Fuel Oil Chemistry Program in combination with the CPEI will be used to manage the aging effect of cracking for copper alloy components exposed to fuel oil in the diesel fuel oil system.

The staff reviewed the applicant's Fuel Oil Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.1, found that the Fuel Oil Chemistry Program provides aging management for loss of material and is also credited with mitigating the aging effect of cracking in susceptible materials through monitoring and control of fuel oil contamination such as water or microbiological organisms, which might produce ammonia that would cause cracking in copper alloy. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER

Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components determined to be most susceptible to the aging effect(s) of interest and uses examination techniques that are capable of detecting cracking if it should occur in the selected components. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs provide both mitigation and detection for the potential aging effect of cracking in copper alloy components exposed to fuel oil in the diesel fuel oil system. On this basis, the staff finds that the applicant's proposed AMPs provide adequate aging management and that the issue raised in RAI 3.3-5 is resolved by the applicant's LRA changes.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material due to selective leaching for cast iron and copper alloy material for level gauges, orifices, piping/tubing, pump casings and valve bodies exposed to an internal environment of fuel oil using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material of carbon steel tanks in an external environment of ventilation by using the Supplementary Piping/Tank Inspection Program. The applicant referenced footnote "G" for this line item indicating that environment is not in the GALL Report for this component and material combination. The environment is an aggressive environment of air-water interface.

The staff reviewed the Supplementary Piping/Tank Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection is performed at very specific locations of air/water interface, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

In Table 3.3.2-7, the LRA states that for synthetic rubber flexible connections in a fuel oil internal environment in the diesel fuel oil system, there are no aging effects requiring management. In RAI 3.3.2.3-1, part A by letter dated July 23, 2008, the staff asked the

applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations. In RAI 3.3.2.3-1, part B, the staff asked the applicant to identify those material properties that could be impacted by exposure of these materials and other materials such as plastic, synthetic rubber, butyl rubber and Teflon, to either a treated water, raw water, fuel oil, lubricating oil, ventilation air, indoor air, and air-gas (including Freon) environments. Finally, in RAI 3.3.2.3-1, part C, the staff asked the applicant to identify the AMP that will be credited for aging management if PPL does identify that are applicable AERMs for any of these system-material-environmental combinations.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1 part A, the applicant stated that the applicable aging effects for elastomers (including butyl rubber, synthetic rubber, neoprene, and silicone) are change in material properties and cracking, which may be due to ionizing radiation, thermal exposure, and exposure to ultraviolet radiation or ozone. The applicant provided the threshold level for ionizing radiation as 10E6 rads, for temperature as greater than 95°F, and for ultraviolet radiation and ozone as prolonged exposure. The applicant further stated that, except for certain areas in the Reactor Building, where ionizing radiation could be more than the threshold limit, the other buildings are all in an environment that is within the threshold limits. Therefore, the applicant concluded that there are no aging effects requiring management for synthetic rubber flexible connections in a fuel oil internal environment in the diesel fuel oil system.

In response to RAI 3.3.2.3-1, part B, the applicant stated that the specific material properties that could be impacted by exposure to treated water, raw water, fuel oil, lubricating oil, ventilation air, indoor air, and air-gas (including Freon) environments are hardening (e.g., embrittlement, decrease in elasticity) and loss of strength (e.g., elongation, loss of tensile strength, and, with exposure to ionizing radiation, swelling or melting). The applicant further stated that hardening and loss of strength could occur as a result of prolonged exposure to high temperature, high radiation levels, or to ultraviolet radiation or ozone.

In response to RAI 3.3.2.3.-1, part C, the applicant stated that there are no aging effects requiring management for the system-material-environment combinations listed in RAI 3.3.2.3-1, except for those that have already been identified in the LRA as noted in the response to Part B.

The staff reviewed the applicant response to RAI 3.3.2.3-1, parts A, B and C, and finds the applicant response acceptable because the applicant defined the stressors that could cause the aging effects in various structures. The applicant response is consistent with the GALL Report definitions of the threshold limits of the stressors as recommended in the GALL Report Section IX. On the basis of its review, the staff finds for synthetic rubber flexible connections in a fuel oil internal environment in the diesel fuel oil system, there are no aging effects requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.

LRA Table 3.3.2-7, summarizes the results of AMRs for the Diesel Fuel Oil System, orifices constructed using copper alloy (brass), level gauges (day tank) constructed from copper alloy (bronze), heat exchangers channels, covers and shells constructed from copper alloy (copper-nickel), valve bodies and tubing (and fittings) constructed from copper alloy (brass and bronze) exposed to indoor air (external), level gauges (day tank) constructed from copper alloy (brass) exposed to ventilation (internal), and piping and piping components constructed from copper

and exposed to lubricating oil (internal). The applicant proposes that for these combinations of components, materials and environment conditions, there is no aging effect requiring management and therefore that no AMR is required.

The applicant has indicated that the GALL Note G is applicable for these items. Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in the GALL for these components and materials. The staff also agrees that there will not be an aging mechanism for this material/environment combination and that no AMP is required. Copper alloy in an air-indoor internal environment has no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure as cited in Metals Handbook, Volume 13, "Corrosion" (American Society for Metals International, 1987).

LRA Table 3.3.2-7 summarizes the results of an AMR for the Diesel Fuel Oil System piping and piping components constructed from carbon steel and exposed to outdoor air (external). The applicant claims that for these combinations of components, materials and environment there is no aging effect requiring management and therefore no AMR is required. The applicant references plant-specific Note 0361. Plant-specific Note 0361 states, Nonsafety-related vent and fill piping and piping components in the Diesel Fuel Oil System are normally empty and are attached to safety-related components (storage tanks or piping) that are anchored in below grade vaults or within Seismic Category I buildings. As such, degradation of the vent and fill piping or piping components will not result in a loss of support for safety-related components to which they are attached. Also, there is no high pressure, other motive force, or medium in the air to cause degradation." Because these components are normally empty, and because even if for some reason, they would fail, they would not affect the intended function of safety-related components, and they are not in scope for license renewal the staff finds this to be acceptable.

The applicant also references Table 3.3.1-58 which covers "Steel external surfaces exposed to air–indoor uncontrolled (external), air–outdoor (external), and condensation (external)" and identifies the aging effect as "Loss of material due to general corrosion" and the AMP as External Surfaces Monitoring. The LRA, in the discussion section states "The System Walkdown Program also manages loss of material due to crevice and/or pitting corrosion due to condensation." The discussion states that this AMR is consistent with GALL while the line item in Table 3.3.2-7 reference Note I, which states that the aging effect is not applicable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.8 Aging Management Review Results - Diesel Generator Buildings HVAC Systems – LRA Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the diesel generator buildings HVAC systems component groups.

LRA Table 3.3.2-8 summarizes the results of AMRs for the Diesel Generator Building HVAC System flexible connectors (ductwork) constructed from neoprene/fiberglass and neoprene/asbestos and neoprene exposed to ventilation (internal) and indoor air (external). The

applicant proposes that these components, materials, environment combinations have no aging effects requiring management and therefore no AMP is required.

The applicant has indicated that generic Note I is applicable for these items. Generic Note I is "*Aging effect in NUREG-1801 for this component, material, and environment is not applicable.*" The staff agrees that there will not be an aging mechanism for this material/environment combination.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.9 Aging Management Review Results - Diesel Generators System – LRA Table 3.3.2-9

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the diesel generators system component groups.

In LRA Table 3.3.2-9, the applicant proposed to manage loss of material of nickel alloy (monel) for heat exchanger heating core tube plugs in the Diesel Generator Intake/Exhaust System exposed to an internal environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the AMP B.2.14 "Closed Cooling Water Chemistry Program." to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008, and supplemented its response by letter dated December 11, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's SSES AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing loss of material for nickel alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage loss of material and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a

sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

In LRA Table 3.3.2-9, the applicant proposed to manage cracking of copper alloy for piping, piping components, tubing, fittings, valve bodies, heater immersion sheaths, and heat exchanger components in the Diesel Generator Lubricating Oil, Jacket Water, Intake/Exhaust and NSAS Component System exposed to an internal or external environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the Closed Cooling Water Program to manage cracking for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination. The Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing cracking for copper and copper alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

In LRA Table 3.3.2-9, the applicant proposed to manage loss of material for aluminum material for heat exchanger shells exposed to an internal environment of lubricating oil using the Lubricating Oil Analysis Program, supplemented by the Lubricating Oil Inspection. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination.

The staff evaluated the Lubricating Oil Analysis Program and the Lubricating Oil Inspection Program, and the evaluations are documented in SER Sections 3.0.3.2.15 and 3.0.3.2.13, respectively. The Lubricating Oil Analysis Program is an existing SSES program that will properly monitor relevant conditions, such as particulate and water concentrations, viscosity, neutralization number and flash point that can lead to start and spread of loss of material or reduction in heat transfer capability. The program's monitoring is based on manufacturer's recommendations, equipment importance and accessibility and ASTM standards for lubricating oils. The applicant will supplement this program with the Lubricating Oil Inspection, which will provide direct evidence as to whether and to what extent reduction of heat transfer has

occurred, thus providing evidence of the effectiveness of the Lubricating Oil Analysis Program. On the basis of its review, the staff finds that because these the lubricating oil in contact with components will properly monitor relevant conditions, such as particulate and water concentrations, viscosity, neutralization number and flash point and then supplemented by a one-time inspection, "Lubricating Oil Inspection" to confirm program effectiveness that the aging effect of loss of material of aluminum exposed to an external environment of lube oil will be adequately managed by these programs.

In LRA Table 3.2.2-9, the applicant proposed to manage reduction of heat transfer in copper alloy heat exchanger tubes in an external environment of lubricating oil by using the Piping Corrosion Program. The applicant referenced footnote H for this line item indicating that aging effect is not in the GALL Report for this component, material and environment combination. However, the staff noted that GALL Report Item V.D2-9 has the same aging effect for this component, material and environment. The GALL Report recommends GALL AMP XI.M39, Lubricating Oil Analysis, and GALL AMP XI.M32, One-Time Inspection. Since the internal environment of these tubes is raw water, these heat exchangers are included in the GL 89-13 program. Therefore, the applicant is proposing to use the Piping Corrosion Program, which is consistent with GALL AMP XI.M20, Open-Cycle Cooling Water System.

The staff reviewed the Piping Corrosion Program, which is a combination of condition monitoring program (consisting of inspections, surveillances, and testing to detect the presence of, and to assess the extent of, fouling and loss of material) and a mitigation program (consisting of chemical treatments and cleaning activities to minimize fouling and loss of material). The staff's evaluation of the Piping Corrosion program is documented in SER Section 3.0.3.2.6. Because the Piping Corrosion Program includes both the chemistry treatment and cleaning for mitigation and inspection for verification, the staff finds that the Piping Corrosion Program will adequately manage the aging effects of reduction of heat transfer in copper alloy heat exchanger tubes in an external environment of lubricating oil through the period of extended operation.

In Table 3.3.2-9, the LRA states that for synthetic rubber flexible connections in a lubricating oil internal environment in the diesel generator system, there are no aging effects requiring management. In RAI 3.3.2.3-1, part A by letter dated July 23, 2008, the staff asked the applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations. In RAI 3.3.2.3-1, part B, the staff asked the applicant to identify those material properties that could be impacted by exposure of these materials and other materials such as plastic, synthetic rubber, butyl rubber and Teflon, to either a treated water, raw water, fuel oil, lubricating oil, ventilation air, indoor air, and air-gas (including Freon) environments. Finally, in RAI 3.3.2.3-1, part C, the staff asked the applicant to Identify the AMP or AMPs that will be credited for aging management if PPL does identify applicable AERMs for any of these system-material-environmental combinations.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1 part A, the applicant stated that the applicable aging effects for elastomers (including butyl rubber, synthetic rubber, neoprene, and silicone) are change in material properties and cracking, which may be due to ionizing radiation, thermal exposure, or exposure to ultraviolet radiation or ozone. The applicant provided the threshold level for ionizing radiation as 10E6 rads, for temperature as greater than 95°F, and for ultraviolet radiation and ozone as prolonged exposure. The applicant further stated that, except for certain areas in the Reactor Building, where ionizing radiation could be more than the threshold limit, the other buildings are all in an environment that is within the threshold limits. Therefore, the applicant concluded that there are no aging effects requiring

management for synthetic rubber flexible connections in a lubricating oil internal environment in the diesel generator system.

In response to RAI 3.3.2.3-1, part B, the applicant stated that the specific material properties that could be impacted by exposure to treated water, raw water, fuel oil, lubricating oil, ventilation air, indoor air, and air-gas (including Freon) environments are hardening (e.g., embrittlement, decrease in elasticity) and loss of strength (e.g., elongation, loss of tensile strength, and, with exposure to ionizing radiation, swelling or melting). The applicant further stated that hardening and loss of strength could occur as a result of prolonged exposure to high temperature, high radiation levels, or to ultraviolet radiation or ozone.

In response to RAI 3.3.2.3.-1, part C, the applicant stated that there are no aging effects requiring management for the system-material-environment combinations listed in RAI 3.3.2.3-1, except for those that have already been identified in the LRA as noted in the response to part B.

The staff reviewed the applicant response to RAI 3.3.2.3-1, parts A, B and C, and finds the applicant response acceptable because the applicant defined the stressors that could cause the aging effects in various structures. The applicant response is consistent with the GALL Report definitions of the threshold limits of the stressors as recommended in the GALL Report Section IX. On the basis of its review, the staff finds for synthetic rubber flexible connections in a lubricating oil internal environment in the diesel generator system, there are no aging effects requiring management.

In Table 3.3.2-9, the LRA states that for plastic (Lucite) level gauges in internal ventilation, lubricating oil and external indoor air environments, and plastic (poly-carbonate) filters in air/gas internal and indoor air external environments in the diesel generator system, there are no aging effects requiring management. In RAI 3.3.2.3-1, by letter dated July 23, 2008, the staff asked the applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1, the applicant stated that

Degradation of plastic materials is considered a design issue. Plastic is either completely resistant to the environment to which it is exposed, or it deteriorates. Acceptability for the use of plastics in any particular environment is a design-driven criterion, and once the appropriate material is chosen, the component will have no aging effects that require management. That is, the occurrence of any aging effects is considered a design deficiency that will be detected and corrected within the current license period.

Therefore, based on a review of industry operating experience and the expectation of proper design and application of the material, aging of plastics is not considered to require further evaluation for license renewal.

The staff reviewed the applicant response and concurs that the selection of plastic material is a design consideration for the system and environment; and once selected for the environment of ventilation, lubricating oil or indoor air, aging of plastic material is not expected. The staff acknowledges that plastic, like glass, is an impervious material and as identified in the GALL Report Item VII.J-8, glass has no aging effects requiring management in an indoor air environment. The staff has not observed any age related industry experience for plastic material in internal ventilation or air/gas and external indoor air environments, and therefore,

finds that for plastic (Lucite) level gauges in internal ventilation, lubricating oil and external indoor air environments, and plastic (poly-carbonate) filters in air/gas internal and indoor air external environments in the diesel generator system will not experience any aging effects requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.

LRA Table 3.3.2-9 summarizes the results of AMRs for the Diesel Generators Lubrication Oil System heat exchangers end bells and shells constructed from aluminum and exposed to indoor air (external). The applicant proposed that there is no aging effect for the material environment combination and that no AMR is required.

LRA Table 3.3.2-9 summarizes the results of AMRs for Diesel Generators System starting air and intake/exhaust valve bodies constructed from nickel alloys (nickel-iron), valve bodies and orifices constructed from copper alloy (bronze), and filter bodies and heat exchanger fins constructed from aluminum exposed to indoor air (external) and ventilation (external). The applicant proposed that there is no aging effect for the material environment combination and that no AMR is required.

The staff finds that this conclusion is acceptable for nickel iron alloys because nickel iron alloys show very low corrosion rates in atmospheric exposure as discussed in F. L. LaQue and H. R. Copson, "Corrosion Resistance of Metals and Alloys," Second Edition, Reinhold Publishing Corporation, New York, 1963. The staff finds that this conclusion is acceptable for copper alloys because copper alloys in air-indoor internal environment has no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure (which is more severe than indoor air or ventilation) as cited in Metals Handbook, Volume 13, "Corrosion" (American Society for Metals International, 1987). The staff finds that his is acceptable for aluminum because aluminum exposed internally to an indoor air environment and externally to ventilation has no applicable aging effect as discussed in M. G. Fontana, "Corrosion Engineering, Third Edition, McGraw-Hill, 1986.

LRA Table 3.3.2-9 summarizes the results of AMRs for the Diesel Generators System intake/exhaust heat exchanger cooling core and heating core tube plugs constructed from nickel alloys (model), heat exchanger cooling core and heating core tube sheets constructed from copper alloy (copper-nickel), heat exchanger cooling core and heating core tubes constructed from copper alloy (copper-nickel) exposed to ventilation (external), heat exchanger water boxes constructed from copper alloy (copper-nickel), and valve bodies constructed from copper alloy (bronze) and exposed to indoor air (exterior), and filter housings constructed from galvanized steel exposed to outdoor air (exterior). For these components, materials and environment combinations, the applicant proposed no aging effect requiring management and no requirement for an AMP.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in the GALL Report for these components and materials. The staff agrees that there will be no aging effect for the tube plugs because they are not exposed to an external environment. The staff agrees with this position because these components do not

have an external surface in contact with an environment because their external surface is in contact with the inside of the heat exchanger tubes.

The staff also agrees that there will not be an aging mechanism for the remaining material/environment combinations and that no AMP is required. The staff noted items include the external surface of components (e.g., heat exchanger shells, piping and piping components, and tanks) that do not contain chilled water, raw water, domestic water or cooling unit drainage and, therefore, do not experience condensation. For copper alloys, items match GALL items V.F-3 and VIII.I-2 for closed water systems, but no such item exists in GALL (Chapter VII) for closed cooling water auxiliary systems.

LRA Table 3.3.2-9 summarizes the results of AMRs for diesel generators NSAS components, process system piping and piping components constructed using copper alloy exposed to indoor air (external). The applicant proposed that there is no aging effect for the material environment combination and that no AMR is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for the component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination, and that no AMP is required.

LRA Table 3.3.2-9 summarizes the results of AMRs for the Diesel Generator intake/exhaust heat exchanger fins constructed from aluminum, diesel generators jacket water heat exchanger tube plugs constructed from copper alloy (copper-nickel) and stainless steel. The applicant proposed that this system meets the definitions given above and therefore the environment, aging effect requiring management, and AMR should be classified as not applicable. The staff agrees with this proposal because these components do not have an internal surface.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.10 Aging Management Review Results - Domestic Water System – LRA Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the domestic water system component groups.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material due for copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by qualified personnel on a sample population of those

components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting loss of material and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-10, the applicant proposed to manage cracking for copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage cracking for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting cracking and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction (e.g., leakage) with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for piping and piping components exposed to an internal environment of raw water and external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual

inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

In Table 3.3.2-10, the LRA states that for glass liner in the domestic water tank under internal exposure to a raw water environment, there are no aging effects identified and no aging management program is required. In RAI 3.3.2.3-1, Part A by letter dated July 23, 2008, the staff asked the applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1 Part A, the applicant stated that:

> The relevant conditions that could result in aging degradation of glass are high temperature water, and/or the presence of hydrofluoric acid or caustic alkalis. Hydrofluoric acid and caustic alkalis are not expected to exist in the raw water environment of the domestic water system. When hot water attacks glass, it is not dissolved in the usual sense but is hydrolytically decomposed. Resistance to water varies from excellent to poor depending on the composition of the glass. Furthermore, glass-lined steel combines the corrosion resistance of glass with the strength of steel, making it useful for equipment operating at elevated temperature and pressure. Glass-lined steel has excellent resistance to corrosion over a wide range of pH and environments. As such, it is expected that the glass lining for the water heater tank is properly designed and selected for the service in which it is used. Therefore, there are no aging effects requiring management for the subject glass components in the domestic water system.

The staff found that the plant-specific AMR for the exposure of the glass liner in the domestic water tank under internal exposure to a raw water environment was consistent with the AMR in GALL AMR item VII.J-11 for exposure of glass components to raw water environments. Based on this review, the staff finds that the applicant has provided a valid basis for concluding that there are not any AERMs for the glass lining in the domestic water system tank because the applicant's AMR is consistent with GALL AMP VII.J-11.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.11 Aging Management Review Results - Emergency Service Water System – LRA Table 3.3.2-11

The staff reviewed LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the emergency service water system component groups.

In LRA Table 3.3.2-11, the applicant proposed to manage loss of material for stainless steel material for piping and piping components exposed to an external environment of outdoor air using the AMP B.2.32 "System Walkdown Program."

The AMR line item credits the AMP B.2.32 "System Walkdown Program" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.32 "System Walkdown Program" is documented in SER Section 3.0.3.2.15. The staff determined that this program is a condition monitoring program that will detect the aging effect of loss of material for metals, including stainless steel, by periodic surveillance activities and observations of components' external surfaces to detect aging degradation that are within the scope of license renewal. The staff also determined that these activities are adequate to manage loss of material for stainless steel piping and piping components exposed to air-outdoor. On this basis, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-11, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program lwithin 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting cracking and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-11, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for piping and piping components exposed to an external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The

staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.12 Aging Management Review Results - ESSW Pumphouse HVAC System – LRA Table 3.3.2-12

The staff reviewed LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the ESSW Pumphouse HVAC system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-12 are consistent with the GALL Report.

3.3.2.3.13 Aging Management Review Results - Fire Protection System – LRA Table 3.3.2-13

The staff reviewed LRA Table 3.3.2-13, which summarizes the results of AMR evaluations for the fire protection system component groups.

In LRA Table 3.3.2-13, the applicant proposed to manage loss of material due to selective leaching for cast iron, gray cast iron and copper alloy material for heat exchanger components, piping, piping components and elements, strainers and sprinkler heads exposed to an external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-13, the applicant proposed to manage loss of material due to selective leaching for cast iron pump casings exposed to an internal environment of fuel oil using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-13, the applicant proposed to manage loss of material due to selective leaching for cast iron pump casings and copper alloy tubing exposed to an internal environment of lubricating oil using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-13, the LRA states that for copper alloy sprinkler heads in indoor air, outdoor air and ventilation environments there are no aging effects. The applicant has referenced footnotes "G" and "0322." Footnote "0322" states that the Fire Water System Program is credited with aging management for all sprinkler heads, regardless of whether aging effects requiring management have been identified.

The staff has determined that copper alloy in an indoor, uncontrolled air environment exhibits no aging effect and that the component or structure will therefore remain capable of performing its intended functions consistent with the CLB for the period of extended operation. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under the supervision of ASTM have confirmed the suitability of copper and copper alloy for atmospheric exposure as cited in Metals Handbook, Volume 13, Corrosion, American Society for Metals, 1987. Based on this review, the staff finds that because the copper alloy sprinkler

heads are exposed to an internal environment that is open to local ambient air conditions such that condensation will not occur, loss of material due to pitting and crevice corrosion is not an aging effect requiring management.

However, the applicant has committed (Commitment No. 46) to enhance the Fire Water System Program prior to entering the period of extended operation to require testing or replacement of sprinkler heads in service for 50 years. On the basis that sprinkler heads are normally open to the atmosphere and that the applicant is committing to testing or replacement of sprinkler heads in service for 50 years, the staff finds these AMR line items to be acceptable.

In Table 3.3.2-13, the LRA states that for synthetic rubber flexible connections in internal environments of fuel oil, raw water and lubricating oil, and for teflon flexible connections in internal raw water environment, there are no aging effects identified and no aging management program is required. The staff issued RAI 3.3.2.3.13-1 by letter dated July 23, 2008, to request the applicant to provide a justification why no aging effects are identified.

In its letter dated August 22, 2008, the applicant responded to RAI 3.3.2.3-13 by stating that change in material properties and cracking of elastomers, such as synthetic rubber may be due to ionizing radiation, thermal exposure, or exposure to ultraviolet radiation, or ozone. The applicant also stated that for polymers, such as Teflon, change in material properties may result from exposure to gamma radiation, but cracking is not a potential aging effect, and change in material properties is not influenced by thermal exposure or exposure to ultraviolet radiation or ozone.

The applicant stated that:

1) The lubricating oil, fuel oil, and raw water environments of the fire protection system contain no sources of ionizing radiation. Therefore, change in material properties and cracking due to ionizing radiation are not aging effects requiring management for synthetic rubber or Teflon components that are exposed to lubricating oil, fuel oil, or raw water.

2) Thermal exposure is an applicable aging mechanism for synthetic rubber components only if they are exposed for prolonged periods to a temperature greater than 95°F. Since there are no significant sources of heat within the diesel driven fire pump room, the applicant assumed that the ambient temperature will not exceed 95°F over a prolonged period. Additionally, the fire protection system is in the standby mode during normal plant operation, so there is normally no flow through the system, and the lubricating oil, fuel oil, and raw water temperatures are approximately the same as the ambient temperature. Therefore, change in material properties and cracking due to thermal exposure are not aging effects requiring management for synthetic rubber flexible connections that are exposed to lubricating oil, fuel oil, or raw water.

3) Ultraviolet radiation and ozone are applicable aging mechanisms only for natural rubber components that are exposed to sources of ultraviolet radiation and ozone. Synthetic rubbers have demonstrated excellent resistance to ultraviolet radiation and ozone. The lubricating oil, fuel oil, and raw water environments contain no sources of ultraviolet radiation and ozone. Therefore, change in material properties and cracking due to

ultraviolet radiation and ozone are not aging effects requiring management for synthetic rubber flexible connections that are exposed to lubricating oil, fuel oil, or raw water.

Based on its review, the staff finds the applicant's response has satisfactorily identified stressors and thresholds for which hardening and loss of strength are aging effects for elastomer components and applied aging management for these cases. Where the stressors and thresholds for which hardening and loss of strength are not exceeded, aging management is not required. This is also confirmed by the GALL Report, Section IX.C, which defines elastomer materials and states that hardening and loss of strength of elastomers can be induced by elevated temperatures (over 95°F), and additional aging factors such as exposure to ozone, oxidation, and radiation. Therefore, the staff finds the applicant response to be acceptable.

In Table 3.3.2-13, the LRA states that for copper and copper alloy tubing and valve bodies in an air-indoor external environment, there are no aging effects identified and no aging management program is required. The applicant has referenced footnote "G", environment not in the GALL Report for this component and material. However, the staff noted GALL Report Item V.F-3 identifies copper alloy in an air-indoor uncontrolled external environment with no aging effects and no aging management program. On the basis that the GALL Report recommends no aging effects for copper alloy piping components in an air-indoor external environment, the staff finds these line items acceptable.

In its letter dated June 30, 2008, in response to RAI B.2.17-2, the applicant amended Table 3.3.2-13, Fire Protection System, to credit the Heat Exchanger Inspection Program to manage the aging effect of reduction of heat transfer due to fouling for copper alloy oil cooler tubes in a lubricating oil external environment. The applicant applied footnote "H." The staff noted that the internal environment of these tubes is raw water and the internal surfaces are managed by the Fire Water System Program for loss of material, which includes actions to ensure no significant corrosion, MIC, or biofouling has occurred, and the Heat Exchanger Inspection Program for reduction of heat transfer. The staff reviewed the Heat Exchanger Inspection Program, which will be inspecting the inner and the external surface of the tubes to detect for fouling. The staff's evaluation of the Heat Exchanger Inspection Program is documented in Section 3.0.3.1.12.

On the basis that the applicant is crediting the Fire Water Inspection Program to ensure no significant fouling is occurring and crediting the Heat Exchanger inspection Program to obtain direct evidence of fouling for the internal surfaces of the tubes, the staff finds that implementation of the Heat Exchanger Inspection for the external surfaces of the tubes in a lubricating oil environment will ensure that the heat transfer capabilities of the subject heat exchangers, and the pressure boundary integrity of the subject tubes, are maintained consistent with the current licensing basis during the period of extended operation.

In Table 3.3.2-13, the LRA states that for synthetic rubber flexible connections in fuel oil and raw water internal environments in the fire protection system, there are no aging effects requiring management. In RAI 3.3.2.3-1, Part A by letter dated July 23, 2008, the staff asked the applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1 Part A, the applicant stated that the applicable aging effects for elastomers (including butyl rubber, synthetic rubber, neoprene, and silicone) are change in material properties and cracking, which may be due to ionizing

radiation, thermal exposure, or exposure to ultraviolet radiation or ozone. The applicant provided the threshold level for ionizing radiation as 10E6 rads, for temperature as greater than 95°F, and for ultraviolet radiation and ozone as prolonged exposure. The applicant further stated that, except for certain areas in the Reactor Building, where ionizing radiation could be more than the threshold limit, the other buildings are all in an environment that is within the threshold limits. Therefore, the applicant concluded that there are no aging effects requiring management for synthetic rubber flexible connections in fuel oil and raw water internal environments in the fire protection system.

The staff reviewed the applicant response to RAI 3.3.2.3-1, Part A, and finds the applicant response acceptable because the applicant defined the stressors that could cause the aging effects in various structures. The applicant response is consistent with the GALL Report definitions of the threshold limits of the stressors as recommended in the GALL Report Section IX. On the basis of its review, the staff finds for synthetic rubber flexible connections in a fuel oil internal environment in the diesel fuel oil system, there are no aging effects requiring management.

In Table 3.3.2-13, the LRA states that for Teflon flexible connections in raw water internal and indoor air external environments in the fire protection system, there are no aging effects requiring management. In RAI 3.3.2.3-1, Part A by letter dated July 23, 2008, the staff asked the applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1, Part A, the applicant stated that:

> The only applicable aging effect for Teflon is change in material properties. Change in material properties of Teflon may be due to exposure to gamma radiation. Thermal exposure and exposure to ultraviolet radiation or ozone are not applicable aging mechanisms for Teflon.
>
> Gamma radiation is an applicable aging mechanism for Teflon components only if the total integrated dose (TID) is equal to or greater than 10E4 rads. The Teflon components in the Fire Protection System are located in the Circulating Water Pumphouse, an area of the plant where ionizing radiation levels are such that the TID over a 60-year period, which includes the period of extended operation, will not equal or exceed 10E3 rads.
>
> Also, there are no sources of gamma radiation expected to exist in the raw water of the Fire Protection System or the treated water environment of the Sampling System.
> Therefore, change in material properties and cracking due to ionizing radiation are not aging effects requiring management for these components.

The staff reviewed the applicant response and noted that these flexible connections are located in an area where the ionizing radiation is less than the threshold value of 10E6 rads. On this basis, the staff finds the applicant response acceptable and concludes that for Teflon flexible connections in raw water internal and indoor air external environments in the fire protection system, there are no aging effects requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.

In Table 3.3.2-13, the LRA states that for galvanized steel piping in an outdoor external environment, there are no aging effects identified and no aging management program is required. The applicant has referenced footnote "G", environment not in the GALL Report for this component and material.

The staff finds that as discussed in M. G. Fontana, "Corrosion Engineering, Third Edition, McGraw-Hill, 1986, this is acceptable for galvanized steel in an outdoor environment because the corrosion protection of the zinc coating is enhanced by the build-up of corrosion products deposited out of solution. The staff finds galvanized steel in an outdoor environment has no aging effects that require aging management because galvanized steel in an outdoor environment has no applicable aging effect as discussed in M. G. Fontana, "Corrosion Engineering, Third Edition, McGraw-Hill, 1986.

In Table 3.3.2-13, the LRA states that for copper alloy halon spray nozzles in an environment of ventilation, there are no aging effects identified and no aging management program is required. The applicant has referenced footnote "G", environment not in the GALL Report for this component and material.

The staff noted that these spray nozzles are in the halon system, which is normally a dry air environment. The staff also noted that these spray nozzles are open to atmosphere. In LRA Table 3.0-1, Internal Environments, the applicant stated that internal ambient environment inside components that are open to the ambient conditions in their location are also included under ventilation environment. Since the spray nozzles are open to atmosphere and would normally be exposed to internal air environment, the staff finds that this material/environment is similar to GALL Report Item VII.I-2, for copper alloy components in an air-indoor uncontrolled environment, with no aging effects and no aging management program required. Based on this review, the staff finds that for copper alloy halon spray nozzles in an environment of ventilation, there are no aging effects identified and no aging management program is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.14 Aging Management Review Results - Fuel Pool Cooling and Cleanup System and Fuel Pool and Auxiliaries – LRA Table 3.3.2-14

The staff reviewed LRA Table 3.3.2-14, which summarizes the results of AMR evaluations for the fuel pool cooling and cleanup system and fuel pool and auxiliaries component groups.

The staff reviewed LRA Table 3.3.2-14 which summarizes the results of AMRs for fuel pool cooling screens for skimmer surge tanks which are constructed from stainless steel. The applicant proposed that this system meets the definitions given above and therefore the environment, aging effect requiring management, and AMR should be classified as not applicable. The staff agrees with this proposal because these components do not have an internal surface.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.15 Aging Management Review Results - Neutron Monitoring System – LRA Table 3.3.2-15

The staff reviewed LRA Table 3.3.2-15, which summarizes the results of AMR evaluations for the neutron monitoring system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-15 are consistent with the GALL Report.

3.3.2.3.16 Aging Management Review Results - Primary Containment Atmosphere Circulation System – LRA Table 3.3.2-16

The staff reviewed LRA Table 3.3.2-16, which summarizes the results of AMR evaluations for the primary containment atmosphere circulation system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-16 are consistent with the GALL Report.

3.3.2.3.17 Aging Management Review Results - Process and Area Radiation Monitoring System – LRA Table 3.3.2-17

The staff reviewed LRA Table 3.3.2-17, which summarizes the results of AMR evaluations for the process and area radiation monitoring system component groups.

In LRA Table 3.3.2-17, the applicant proposed to manage cracking of copper alloy for piping and piping components in the Process and Area Radiation Monitoring System exposed to an internal environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the Closed Cooling Water Program to manage cracking for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination. The Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing cracking for copper and copper alloy components exposed to a treated water environment. The staff further

noted the Closed Cooling Water Chemistry Program is an existing program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

LRA Table 3.3.2-17 summarizes the results of AMRs for process and area radiation monitoring system piping and piping components constructed using copper alloy exposed to indoor air (external). The applicant proposed that there is no aging effect for the material environment combination and that no AMR is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for the component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination, and that no AMP is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.18 Aging Management Review Results - Radwaste Liquid System – LRA Table 3.3.2-18

The staff reviewed LRA Table 3.3.2-18, which summarizes the results of AMR evaluations for the radwaste liquid system component groups.

In LRA Table 3.3.2-18, the applicant proposed to manage loss of material due to selective leaching for cast iron for piping and piping components exposed to an internal environment of raw water using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. The staff noted that the GALL Report recommends the use of the Selective Leaching Program for the same combination of material/environment/aging effect in items

VII.C1-11 for a different system. On the basis that the applicant will be performing a combination of a visual inspection and hardness test for these components and these AMR material/environment/aging effect combination is consistent with the GALL AMR Item VII.C1-11 for cast iron, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-18, the applicant proposed to manage loss of material in piping and piping components, and cleanouts and pump casings in an internal environment of raw water by using the Monitoring and Collection System Inspection Program. The applicant referenced footnote G for this line item indicating that environment is not in the GALL Report for this component and material combination. The applicant also referenced footnote 0356, which indicates that uncontrolled drainage in the radwaste liquids system is considered to be a raw water environment.

The staff noted that these components are in scope for a structural integrity function only to ensure that its failure does not impact other safety-related system and components. The staff reviewed the Monitoring and Collection System Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Monitoring and Collection System Inspection Program is documented in SER Section 3.0.3.1.15. Because the Monitoring and Collection System Inspection is performed at susceptible locations, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Monitoring and Collection System Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.19 Aging Management Review Results - Radwaste Solids Handling System – LRA Table 3.3.2-19

The staff reviewed LRA Table 3.3.2-19, which summarizes the results of AMR evaluations for the radwaste solids handling system component groups.

In LRA Table 3.3.2-19, the applicant proposed to manage loss of material due for carbon steel, stainless steel and copper alloy material for piping and piping components and tanks exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting loss of material and the applicant will initiate corrective actions if an

unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-19, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting cracking and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction (e.g., leakage) with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-19, the applicant proposed to manage loss of material due to selective leaching for copper alloy for piping and piping components exposed to an internal environment of raw water using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. The staff noted that the GALL Report recommends the use of the Selective Leaching Program for the same combination of material/environment/aging effect in items VII.C1-10 for a different system. On the basis that the applicant will be performing a combination of a visual inspection and hardness test for these components and these AMR material/environment/aging effect combination is consistent with the GALL AMR Item VII.C1-10 for copper alloy, the staff finds the AMR results for this line item acceptable.

LRA Table 3.3.2-19 summarizes the results of AMRs for the Radwaste Solids Handling System piping and piping components constructed from copper alloy and exposed to indoor air (external) and the applicant proposed that this material-environment combination has no aging effects requiring management and no AMR is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in the GALL Report for this component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination and that no AMP is required. Copper alloys in an air-indoor internal environment have no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure (which is more severe than indoor air) as cited in Metals Handbook, Volume 13, "Corrosion" (American Society for Metals International, 1987).

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.20 Aging Management Review Results - Raw Water Treatment System – LRA Table 3.3.2-20

The staff reviewed LRA Table 3.3.2-20, which summarizes the results of AMR evaluations for the raw water treatment system component groups.

In LRA Table 3.3.2-20, the applicant proposed to manage loss of material due to selective leaching for cast iron and copper alloy material for valve bodies exposed to an external environment of outdoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.21 Aging Management Review Results - Reactor Building Chilled Water System – LRA Table 3.3.2-21

The staff reviewed LRA Table 3.3.2-21, which summarizes the results of AMR evaluations for the reactor building chilled water system component groups.

In LRA Table 3.3.2-21, the applicant proposed to manage cracking of copper alloy for piping and piping components in the Reactor Building Chilled Water System exposed to an internal environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the Closed Cooling Water Program to manage cracking for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination. The Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing cracking for copper and copper alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

In LRA Table 3.3.2-21, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques

(nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting cracking and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-21, the applicant proposed to manage loss of material due to selective leaching for cast iron and copper alloy material for chillers, piping and piping components and elements exposed to an external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components the staff finds the AMR results for this line item acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.22 Aging Management Review Results - Reactor Building Closed Cooling Water System – LRA Table 3.3.2-22

The staff reviewed LRA Table 3.3.2-22, which summarizes the results of AMR evaluations for the reactor building closed cooling water system component groups.

In LRA Table 3.3.2-22, the applicant proposed to manage cracking of copper alloy for piping and piping components in the Reactor Building Closed Cooling Water System exposed to an internal environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the Closed Cooling Water Program to manage cracking for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff noted that on LRA page 3.3-289 in LRA Table 3.3.2-22, the applicant referenced a NUREG-1801 Volume 2 item and then cited a Note H, which indicates that this aging effect is not in NUREG-1801 for this component, material and environment combination. It was unclear to the staff why the applicant referenced a GALL line item and cited a Note H, therefore by letter dated July 23, 2008, the staff issued RAI 3.3.2-4, requesting the applicant to clarify the applicability of this GALL item to the LRA Table 2 item. By letter dated August 22, 2008, the applicant responded to RAI 3.3.2-4, in which the applicant stated this was an error in the LRA and that based upon their review, this was the only instance in which copper alloy subject to cracking in a treated water environment referenced a GALL item. The staff confirmed the applicant amended the LRA to remove the reference to the GALL line item and replaced it with "N/A." On the basis of its review, the staff finds the applicant's response acceptable because the LRA was amended and the error was corrected.

During its review, it was unclear to the staff whether SSES would be supplementing the Closed Cooling Water Chemistry Program with a one-time inspection, either the Chemistry Effectiveness Program or Heat Exchanger Inspection Program. Therefore by letter dated August 12, 2008, the staff issued RAI B.2.14-2 requesting the applicant to clarify whether an appropriate one-time inspection will supplement the Closed Cooling Water Chemistry Program whenever credited and to identify which one-time inspection would be used.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing cracking for copper and copper alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or
VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

LRA Table 3.3.2-22 summarizes the results of AMRs for reactor building closed cooling water, system piping and piping components constructed using copper alloy exposed to indoor air (external). The applicant proposed that there is no aging effect for the material environment combination and that no AMR is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for the component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination, and that no AMP is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.23 Aging Management Review Results - Reactor Building HVAC System – LRA Table 3.3.2-23

The staff reviewed LRA Table 3.3.2-23, which summarizes the results of AMR evaluations for the reactor building HVAC system component groups.

In Table 3.3.2-23, the LRA states that for glass sight gauges in the reactor building HVAC system exposed to Freon environment, there are no aging effects identified and no aging management program is required. The staff was concerned, however, that the Freon environment for the glass sight gauges in the reactor building HVAC system might create sufficiently cold environments for the glass material that could, at a minimum impact the fracture toughness of the material. Hence, the staff was concerned that the Freon environment might impact the tolerance of the glass material to withstand an existing crack in the glass material used to fabricate the components (i.e., reduce the flaw tolerance of the material). In RAI 3.3.2.3-2 by letter dated July 23, 2008, the staff asked the applicant to justify why reduction of fracture toughness and cracking would not be applicable aging effects requiring management for the surfaces of glass sight gauges in the reactor building HVAC system under internal exposure to an air – gas (Freon) environment.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-2, the applicant stated:

> The only relevant conditions that could result in aging degradation (such as cracking) of glass, as identified by industry operating experience, and by research conducted by the Electric Power Research Institute, are exposure to high-temperature water, and/or exposure to hydrofluoric acid or caustic alkalis. High-temperature water, hydrofluoric acid, and caustic alkalis are not expected to exist in the air-gas (Freon) environment of the Reactor Building HVAC System.
>
> Exposure to low temperature has not been identified as a relevant condition that could result in aging degradation of glass. Also, reduction in fracture toughness has not been identified as an applicable aging effect for glass, which is by definition a brittle material when subject to impact.
>
> Additionally, the coldest part of the refrigeration cycle, expansion, is typically in the range of approximately 30'F to 40'F, which is not exceptionally cold. The subject glass sight gauges, however, are located between the components of compression and expansion cycles, where the temperature is typically in the range of approximately 95°F to 110°F.

The staff reviewed the applicant response and noted that the coldest temperature the glass material would experience during normal operation is between 30°F to 40°F, which are not very cold temperatures and at those temperatures the glass material will be resistant to cracking. Based on the operating conditions, and also the location of the sight glasses between components of compression and expansion cycles, the staff finds that the glass material in a Freon environment will not experience any aging effects requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.

LRA Table 3.3.2-23 summarizes the AMR results for the emergency switchgear (SWGR) and load center rooms cooling coils constructed from copper exposed to ventilation (internal) and the applicant proposed that this material-environment combination has no aging effects requiring management and no AMR is required.

The applicant has indicated that generic Note I is applicable for these items. Generic Note I is "Aging effect in NUREG-1801 for this component, material, and environment is not applicable." The staff agrees that there will not be an aging mechanism for this material/environment combination. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure (which is more severe or ventilation) as cited in Metals Handbook, Volume 13, "Corrosion" (American Society for Metals International, 1987).

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

LRA Table 3.3.2-23 summarizes the AMR results for reactor building HVAC system valve bodies made from copper alloy (bronze and brass) and tubing made from copper and exposed to indoor air (external), sight gauges made from glass exposed to air-gas (Freon) (internal), piping and cooling units, emergency SWGR and load center room DX type cooling coils made from copper and exposed to indoor air (external), and cooling units, emergency SWGR and load center rooms cooling coils made from copper alloy (copper-nickel) exposed to ventilation (external). The applicant proposed that this material-environment combination has no aging effects requiring management and no AMR is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for this component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination and that no AMP is required. Copper alloy in air-indoor internal environment has no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure (which is more severe than indoor air) as cited in Metals Handbook, Volume 13, "Corrosion" (American Society for Metals International, 1987). This conclusion is also based on the fact that there have been no aging effects observed for glass components in this air environment. Ref: Handbook of Glass Properties, N. P. Bansal and R. H. Doremua, Academic Press 1986, pg. 646.

The staff reviewed LRA Table 3.3.2-23 which summarizes the results of AMRs for the Reactor Building HVAC System, unit coolers, CSP pump room RHR pump room, RCIC pump room, and HPCI pump room tube plugs constructed from stainless steel, and unit coolers, CSP pump room, RHR pump room, RCIC pump room, and HPCI pump room fins constructed from copper, and condenser water cooled tube plugs constructed from copper alloy (copper-nickel). The applicant proposed that this system meets the definitions given above and therefore the environment, aging effect requiring management, and AMR should be classified as not applicable. The staff agrees with this proposal because these components do not have an internal surface because they are solid and therefore, there will not be an aging effect requiring an AMP.

In LRA Table 3.3.2-23, the applicant proposed to manage reduction of heat transfer of copper cooling unit fins in an external environment of ventilation by using the Cooling Units Inspection Program. The applicant referenced Note H for this line item indicating that aging effect is not in the GALL Report for this component, material and environment combination.

The staff noted the Cooling Unit Inspection Program will detect and charaterize the condition of cooling unit components that are exposed to a ventilation environment, and provides direct evidence as to whether, and to what extent, reduction of heat transfer has occurred, or is likely to occur that could result in a loss of intended function. In its letter dated July 25, 2008, the applicant responded to RAI B.2.23-2 stating that visual inspection (VT-3 or equivalent) techniques will be used to determine whether reduction in heat transfer is occurring. The applicant also stated that the specific inspection technique will be determined prior to the inspection activities and will be consistent with the recommendations in GALL AMP XI.M32. The staff's evaluation of the Cooling Units Inspection Program is documented in SER Section 3.0.3.1.11. Because the Cooling Units Inspection Program performs visual inspection to determine if any fouling has occurred that could cause reduction of heat transfer, and on the basis that the visual inspection technique will be consistent with the recommendation in GALL AMP XI.M32, the staff finds the Cooling Units Inspection Program will adequately manage the aging effect of reduction of heat transfer in cooling unit components exposed to a ventilation environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.24 Aging Management Review Results - Reactor Nonnuclear Instrumentation System – LRA Table 3.3.2-24

The staff reviewed LRA Table 3.3.2-24, which summarizes the results of AMR evaluations for the reactor nonnuclear instrumentation system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-24 are consistent with the GALL Report.

3.3.2.3.25 Aging Management Review Results - Reactor Water Cleanup System – LRA Table 3.3.2-25

The staff reviewed LRA Table 3.3.2-25, which summarizes the results of AMR evaluations for the reactor water cleanup system component groups.

In LRA Tables 3.2.2-25 the applicant proposed to manage cracking in copper alloy piping and piping components in an environment of treated water by using the BWR Water Chemistry Program, alone. The applicant cited generic Note H for these AMR results, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. In a letter dated July 15, 2008, the staff issued RAI 3.2-3, applicable for these AMR results and for similar AMR results in LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, and 3.4.2 3. The RAI asked the applicant to provide a technical justification as to why an inspection program, such as the CPEI is not needed to confirm that the BWR Water Chemistry Program is effective in preventing the aging effect.

In a letter dated August 15, 2008, the applicant responded to RAI 3.3-3 by providing the following response:

For the five AMR results lines listed in LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3, where the material is copper alloy, the environment is treated water (internal), and the aging effect is cracking, verification of the effectiveness of the BWR Water Chemistry Program is needed. The CPEI will provide confirmation of the effectiveness of this program in managing the effects of aging, including cracking in susceptible materials.

LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3 are revised to reflect these results.

The staff reviewed the applicant's response and the associated LRA changes. The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of cracking due to stress corrosion cracking. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and uses examination techniques that are capable of detecting cracking, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection of the aging effect if it should occur, the staff finds the applicant's proposed AMPs for managing the potential aging effect of cracking due to stress corrosion cracking in copper alloy piping and piping components exposed to treated water in the reactor water cleanup system to be acceptable. On this basis, the staff finds that the issue in RAI 3.2 3 is resolved by the applicant's LRA changes.

In LRA Table 3.3.2-25, the applicant applied Note H for carbon steel piping and valve bodies exposed to an internal environment of treated water in the reactor water cleanup system. The applicant proposed to manage loss of material due to flow-accelerated corrosion by using the Flow-Accelerated Corrosion Program. The definition of footnote "H" implies that these line items are not consistent with GALL Report. However, the applicant has identified GALL Report Item VII.E3-18, which is for loss of material due to general, pitting and crevice corrosion. Furthermore, footnote "H" states that aging effect is not in the GALL Report for this component, material and environment combination. Yet in the same table, the LRA has another line item for the same component, material and environment combination with an aging effect of loss of material due to flow-accelerated corrosion where the LRA has referenced footnote "A" and correctly identified GALL Report Item VIII.D2-8.

Since the GALL Report addresses the aging effect of loss of material due to flow-accelerated corrosion for this component, material and environment combination, the staff issued RAI 3.3.2.3.25-1 by letter dated July 9, 2008, requesting the applicant to justify why footnote "H" was identified in these two line items and footnote "A" in other line item in the same system. The staff also asked the applicant to justify why a GALL Report item number was referenced with footnote "H."

In its letter dated August 8, 2008, the applicant responded to RAI 3.3.2.3.25-1 by stating that there is no line item in GALL Chapter VII, Section E3, Reactor Water Cleanup System, for loss of material due to flow-accelerated corrosion and therefore, comparison to Chapter VII should not have been made. The applicant further stated that similar to other line items in Table 3.3.2-25 for which the FAC program was credited, comparison should have been made to GALL Item VIII.D2-8. The applicant revised the subject line item to refer to GALL Item VIII.D2-8 and Table 3.4.1, item 3.4.1-29, which is applicable to FAC. The applicant changed footnote H to footnote A and the line item is consistent with the GALL Report.

The staff reviewed the changes and compared them with GALL Item VIII.D2-8, and noted that the material, environment, aging effect and recommended AMP are the same as in the GALL Report. On this basis, the staff finds the applicant response acceptable.

LRA Table 3.3.2-25 summarizes the results of AMRs for reactor water cleanup system piping and piping components constructed using copper alloy exposed to indoor air (external). The applicant proposed that there is no aging effect for the material environment combination and that no AMR is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for the component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination, and that no AMP is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.26 Aging Management Review Results - RHR Service Water System – LRA Table 3.3.2-26

The staff reviewed LRA Table 3.3.2-26, which summarizes the results of AMR evaluations for the RHR service water system component groups.

In LRA Table 3.3.2-26, the applicant proposed to manage loss of material for stainless steel material for piping and piping components exposed to an external environment of outdoor air using the AMP B.2.32 "System Walkdown Program."

The AMR line item credits the AMP B.2.32 "System Walkdown Program" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.32 "System Walkdown Program" is documented in SER

Section 3.0.3.2.15. The staff determined that this program is a condition monitoring program that will detect the aging effect of loss of material for metals, including stainless steel, by periodic surveillance activities and observations of components' external surfaces to detect aging degradation that are within the scope of license renewal. The staff also determined that these activities are adequate to manage loss of material for stainless steel piping and piping components exposed to air-outdoor. On the basis that the applicant will be performing periodic visual inspections of these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-26, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting cracking and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-26, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for piping and piping components and elements exposed to an external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-26, the applicant proposed to manage loss of material of carbon steel piping in an internal environment of ventilation by using the Supplementary Piping/Tank Inspection Program. The applicant referenced footnote "G" for this line item indicating that environment is not in the GALL Report for this component and material combination. The environment is an aggressive environment of air-water interface.

The staff reviewed the Supplementary Piping/Tank Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection Program is performed at very specific locations of air/water interface, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.27 Aging Management Review Results - Sampling System – LRA Table 3.3.2-27

The staff reviewed LRA Table 3.3.2-27, which summarizes the results of AMR evaluations for the sampling system component groups.

In LRA Table 3.3.2-27, the applicant proposed to manage cracking of copper alloy for piping and piping components and chiller components (condenser channel header, evaporator shell and integral piping/tubing) in the Sampling System exposed to an internal environment of treated water using the AMP B.2.14 "Closed Cooling Water Chemistry Program."

The AMR line item credits the Closed Cooling Water Program to manage cracking for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination. The Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the scope of license renewal, consistent with relevant EPRI water chemistry guidelines.

The applicant responded to RAI B.2.14-2, in a letter dated August 12, 2008. The applicant clarified that the one-time inspection performed as part of the AMP B.2.22, "Chemistry Program Effectiveness Inspection" will be used to supplement AMP B.2.14, "Closed Cooling Water Chemistry Program" in all instances where AMP B.2.14 is credited for aging management in LRA Table-2 items, with the exception of the Diesel Jacket Water Cooling System. The staff reviewed the applicant's AMP B.2.14 "Closed Cooling Water Chemistry Program" and AMP B.2.22 "Chemistry Program Effectiveness Inspection" and its evaluations are documented in SER Section 3.0.3.2.7 and 3.0.3.1.10, respectively. The staff verified that this aging management program includes activities that are consistent with the recommendations in the GALL AMP XI.M21 to maintain high water purity, which is effective for managing cracking for copper and copper alloy components exposed to a treated water environment. The staff further noted the Closed Cooling Water Chemistry Program is an existing SSES program that properly monitors components and controls corrosion inhibitor concentrations for components, within the

scope of license renewal, consistent with relevant EPRI water chemistry guidelines. The staff confirmed that the CPEI will be used to verify the effectiveness of the applicant's Closed Cooling Water Chemistry Program to manage cracking and that a combination of appropriate volumetric and visual examination techniques (such as VT-1 or VT-3) will be performed by qualified personnel on a sample population of most susceptible subject components. On this basis, the staff finds that these AMR results will be adequately managed by these programs.

In LRA Table 3.3.2-27, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for chiller components (channel/header, integral piping/tubing and evaporator shell) exposed to an external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

In Table 3.3.2-27, the LRA states that for Teflon piping and piping components in treated water internal environment in the sampling system, there are no aging effects requiring management. In RAI 3.3.2.3-1, part A by letter dated July 23, 2008, the staff asked the applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1, Part A, the applicant stated that:

> The only applicable aging effect for Teflon is change in material properties. Change in material properties of Teflon may be due to exposure to gamma radiation. Thermal exposure and exposure to ultraviolet radiation or ozone are not applicable aging mechanisms for Teflon.
>
> Gamma radiation is an applicable aging mechanism for Teflon components only if the total integrated dose (TID) is equal to or greater than 10E4 rads. The Teflon components in the Fire Protection System are located in the Circulating Water Pumphouse, an area of the plant where ionizing radiation levels are such that the TID over a 60-year period, which includes the period of extended operation, will not equal or exceed 10E3 rads. Also, there are no sources of gamma radiation expected to exist in the raw water of the Fire Protection System or the treated water environment of the Sampling System. Therefore, change to

the material properties and cracking due to ionizing radiation are not aging effects requiring management for these components.

The staff reviewed the applicant response and noted that these piping and piping components are located in an area where the ionizing radiation is less than the threshold value of 10E6 rads. On this basis, the staff finds the applicant response acceptable and concludes that for Teflon piping and piping components in treated water internal environment in the sampling system, there are no aging effects requiring management.

In Table 3.3.2-27, the applicant stated that Teflon piping and piping components in an indoor air external environment has an aging effect of change in material properties and has credited the System Walkdown Program to manage this aging effect. In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1, the applicant stated that these Teflon piping and piping components are located in areas of the Reactor Building where these components could be exposed to ionizing radiation greater than 10E6 rads and to temperatures greater than 95°F. Therefore, the applicant has identified the aging effect of change in material properties.

In RAI B.2.32-4, the staff asked the applicant to justify its basis for crediting the System Walkdown Program to manage cracking and changes in material properties that may occur in the internal surfaces of in-scope components that are fabricated from non-metallic material. In its letter dated August 12, 2008, in response to RAI B.2.32-4, the applicant revised the LRA to include additional enhancements to address the management of changes in material properties of elastomer and polymer materials. The staff's acceptance of the System Walkdown Program to manage this aging effect and its discussion of RAI B.2.32-4 are documented in SER Section 3.0.3.2.14. The staff determined the applicant will supplement a visual inspection performed during periodic system walkdowns with a supplemental physical manipulation and/or prodding to inspect elastomer and polymer components. The staff noted that the physical manipulation will aid the visual inspection in detecting age-related degradation because changes in material properties and cracking can be detected during manipulation of elastomeric and polymeric components by the relative inflexibility of the component, or by the failure of the component to return to its previous shape or configuration. Based on this review, the staff concludes that the System Walkdown Program will adequately manage the aging effect of change in material properties of Teflon piping and piping components during the period of extended operation.

LRA Table 3.3.2-27 summarizes the results of AMRs for sampling system piping and piping components constructed using copper alloy exposed to indoor air (external). The applicant proposed that there is no aging effect for the material environment combination and that no AMR is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for the component and material. The staff also agrees that there will not be an aging mechanism for this material/environment combination, and that no AMP is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.28 Aging Management Review Results - Sanitary Drainage System LRA Table 3.3.2-28

The staff reviewed LRA Table 3.3.2-28, which summarizes the results of AMR evaluations for the sanitary drainage system component groups.

In LRA Table 3.3.2-28, the applicant proposed to manage loss of material due for cast iron and carbon steel material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by a qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting loss of material and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-28, the applicant proposed to manage loss of material due to selective leaching for cast iron for piping and piping components exposed to an internal environment of raw water using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in GALL Report for this component and material combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program at least 10 years prior to entering the period of extended operation such that the condition of the material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. The staff noted that the GALL Report recommends the use of the Selective Leaching Program for the same combination of material/environment/aging effect in items VII.C1-11 for a different system. On the basis that the applicant will be performing a combination of a visual inspection and hardness test for these components and these AMR material/environment/aging effect combination is consistent with the GALL AMR Item VII.C1-11 for cast iron, the staff finds the AMR results for this line item acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.29 Aging Management Review Results - Service Air System – LRA Table 3.3.2-29

The staff reviewed LRA Table 3.3.2-29, which summarizes the results of AMR evaluations for the service air system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-29 are consistent with the GALL Report.

3.3.2.3.30 Aging Management Review Results - Service Water System – LRA Table 3.3.2-30

The staff reviewed LRA Table 3.3.2-30, which summarizes the results of AMR evaluations for the service water system component groups.

In LRA Table 3.3.2-30, the applicant proposed to manage cracking for copper alloy material for piping and piping components exposed to an internal environment of raw water using the AMP B.2.46 "Area-Based NSAS Inspection."

The AMR line items credit the AMP B.2.46 "Area-Based NSAS Inspection" to manage loss of material for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the Gall Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.46 is documented in SER Section 3.0.3.3.1. The staff noted that this program is a plant-specific program that performs an appropriate combination of established volumetric and visual inspection techniques (nondestructive examination techniques) that will be performed by qualified personnel on a sample population of those components in scope of this program. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation. The staff determined the inspection techniques will be capable of detecting cracking and the applicant will initiate corrective actions if an unacceptable loss of material or wall thinning has occurred that may have a spatial interaction with safety-related components, as determined by engineering evaluation. On the basis that the applicant will be performing an appropriate combination of a visual inspection and volumetric testing for these components, the staff finds the AMR results for this line item acceptable.

In LRA Table 3.3.2-30, the applicant proposed to manage loss of material due to selective leaching for copper alloy material for piping and piping components exposed to an external environment of indoor air using the AMP B.2.29 "Selective Leaching Inspection."

The AMR line items credit the AMP B.2.29 "Selective Leaching Inspection" to manage loss of material due to selective leaching for these components. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination. The staff's evaluation of the AMP B.2.29 is documented in SER Section 3.0.3.2.17. The staff noted that this program is a one-time inspection that will perform a combination of visual inspection and hardness testing to determine if loss of material due to selective leaching has occurred. The staff further noted that the applicant will perform the inspections of the components within the scope of this program within 10 years prior to entering the period of extended operation such that the condition of the

material is more representative of the conditions during the period of extended operation. The staff determined the applicants proposed inspection techniques to detect loss of material due to selective leaching are consistent with the inspection techniques recommended in GALL AMP XI.M33 and the applicant will initiate corrective actions based on the evaluation of the results of these inspections. On the basis that the applicant will be performing a combination of a visual inspection and hardness test, which is consistent with the recommendations in GALL AMP XI.M33, for these components, the staff finds the AMR results for this line item acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.31 Aging Management Review Results - Standby Liquid Control System – LRA Table 3.3.2-31

The staff reviewed LRA Table 3.3.2-31, which summarizes the results of AMR evaluations for the SLC system component groups.

In LRA Table 3.3.2-31, the applicant proposed to manage loss of material of stainless steel tanks in an internal environment of ventilation by using the Supplementary Piping/Tank Inspection Program. The applicant referenced footnote "J" for this line item indicating that neither the component nor the material and environment combination is evaluated in the GALL Report. The applicant also references footnote 0338, indicating loss of material is due to crevice and/or pitting corrosion at the air/water interface within the SLC Storage Tank.

The staff reviewed the Supplementary Piping/Tank Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection is performed at very specific locations of air/water interface, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

In Table 3.3.2-31, the LRA states that for butyl rubber accumulators that are exposed internally to a nitrogen air gas environment and externally to treated water, there are no aging effects requiring management. In RAI 3.3.2.3-1, Part A by letter dated July 23, 2008, the staff asked the applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations.

In its letter dated August 27, 2008, in response to RAI 3.3.2.3-1 part A, the applicant stated that the applicable aging effects for elastomers (including butyl rubber, synthetic rubber, neoprene, and silicone) are changes in material properties and cracking, which may be due to ionizing radiation, thermal exposure, or exposure to ultraviolet radiation or ozone. The applicant provided the threshold level for ionizing radiation as 10E6 rads, for temperature as greater than 95°F, and for ultraviolet radiation and ozone as prolonged exposure. The applicant further stated that, except for certain areas in the Reactor Building, where ionizing radiation could be more than the threshold limit, the other buildings are all in an environment that is within the threshold limits. Therefore, the applicant concluded that there are no aging effects requiring

management for butyl rubber accumulators that are exposed internally to a nitrogen air gas environment and externally to treated water in the standby liquid control system.

The staff reviewed the applicant response to RAI 3.3.2.3-1, part A, and finds the applicant response acceptable because the applicant defined the stressors that could cause the aging effects in various structures. The applicant response is consistent with the GALL Report definitions of the threshold limits of the stressors as recommended in the GALL Report Section IX. On the basis of its review, the staff finds for butyl rubber accumulators that are exposed internally to a nitrogen air gas environment and externally to treated water in the standby liquid control system, there are no aging effects requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.32 Aging Management Review Results - Turbine Building Closed Cooling Water System – LRA Table 3.3.2-32

The staff reviewed LRA Table 3.3.2-32, which summarizes the results of AMR evaluations for the turbine building closed cooling water system component groups.

The staff reviewed LRA Table 3.3.2-32, which summarizes the results of AMR evaluations for the turbine building closed cooling water system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-32 are consistent with the GALL Report.

3.3.2.3.33 Aging Management Review Results - Reactor Recirculation System (NSAS Portions) – LRA Table 3.3.2-33

The staff reviewed LRA Table 3.3.2-33, which summarizes the results of AMR evaluations for the reactor recirculation system (NSAS) component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-33 are consistent with the GALL Report.

3.3.2.3.34 Aging Management Review Results - Reactor Vessel and Auxiliaries System (NSAS Portions) – LRA Table 3.3.2-34

The staff reviewed LRA Table 3.3.2-34, which summarizes the results of AMR evaluations for the RV and auxiliaries system (NSAS portions) component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-33 are consistent with the GALL Report.

3.3.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

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

- Auxiliary Boiler System
- Bypass Steam System
- Condensate Transfer and Storage System
- Condenser and Air Removal System
- Feedwater System
- Main Steam System
- Main Turbine System
- Makeup Demineralizer System
- Makeup Transfer and Storage System
- Refueling Water Transfer and Storage System

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides AMR results for the steam and power conversion systems components and component groups. LRA Table 3.4.1, "Summary of Aging Management Programs for Steam and Power Conversion Systems Evaluated in Chapter VIII of the GALL Report," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the steam and power conversion systems components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry OE in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry OE included a review of the GALL Report and OE issues identified since the issuance of the GALL Report.

3.4.2 Staff Evaluation

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

The staff conducted an onsite audit of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.4.2.1.

In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.4.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.4.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.4.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

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

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

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.1)
Steel piping, piping components, and piping elements exposed to steam (3.4.1-2)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable. The applicant addresses these components under GALL Report Item number 3.4.1-4. (See SER Section 3.4.2.2.2.1)
Steel heat exchanger components exposed to treated water (3.4.1-3)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.4.2.2.2.1)
Steel piping, piping components, and piping elements exposed to treated water (3.4.1-4)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.4.2.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel heat exchanger components exposed to treated water (3.4.1-5)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not Applicable. There are no steel heat exchanger components in-scope for license renewal in the steam and power conversion system. (See SER Section 3.4.2.2.9)
Steel and stainless steel tanks exposed to treated water (3.4.1-6)	Loss of material due to general (steel only) pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.4.2.2.2.1, and SER Section 3.4.2.2.7.1)
Steel piping, piping components, and piping elements exposed to lubricating oil (3.4.1-7)	Loss of material due to general, pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable (See SER Section 3.4.2.2.2.2)
Steel piping, piping components, and piping elements exposed to raw water (3.4.1-8)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion, and fouling	Plant-specific	Yes	Not applicable	Not applicable (See SER Section 3.4.2.2.3)
Stainless steel and copper alloy heat exchanger tubes exposed to treated water (3.4.1-9)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not Applicable (See SER Section 3.4.2.2.4.1)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil (3.4.1-10)	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable (See SER Section 3.4.2.2.4.2)
Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil (3.4.1-11)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Not applicable	Not applicable (See SER section 3.4.2.2.5.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel heat exchanger components exposed to lubricating oil (3.4.1-12)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not Applicable (See SER Section 3.4.2.2.5.2)
Stainless steel piping, piping components, piping elements exposed to steam (3.4.1-13)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.4.2.2.6)
Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water > 60°C (> 140°F) (3.4.1-14)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable. The applicant addresses these components under GALL Report Item number 3.4.1-13. (See SER Section 3.4.2.2.6)
Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water (3.4.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with the GALL Report (See SER Section 3.4.2.2.7.1)
Stainless steel piping, piping components, and piping elements; tanks, and heat exchanger components exposed to treated water (3.4.1-16)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection (B.2.22)	Consistent with GALL Report (See SER Section 3.4.2.2.7.1)
Stainless steel piping, piping components, and piping elements exposed to soil (3.4.1-17)	Loss of material due to pitting and crevice corrosion	Plant-specific	Yes	Buried Piping and Tanks Inspection Program	See SER Section 3.4.2.2.7.2

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.4.1-18)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable (See SER Section 3.4.2.2.7.3)
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil (3.4.1-19)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable (See SER Section 3.4.2.2.8)
Steel tanks exposed to air - outdoor (external) (3.4.1-20)	Loss of material, general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	System Walkdown Program (B.2.32) and Condensate and Refueling Water Storage Tank Inspection (B.2.19)	Consistent with GALL Report
High-strength steel closure bolting exposed to air with steam or water leakage (3.4.1-21)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Steel bolting and closure bolting exposed to air with steam or water leakage, air - outdoor (external), or air - indoor uncontrolled (external); (3.4.1-22)	Loss of material due to general, pitting and crevice corrosion; loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water > 60°C (> 140°F) (3.4.1-23)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	BWR Water Chemistry Program (B.2.2) and Chemistry Program Effectiveness Inspection Program (B.2.22)	Evaluated in line item 3.4.1-13 (See SER Section 3.4.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel heat exchanger components exposed to closed cycle cooling water (3.4.1-24)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.4.1-25)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water (3.4.1-26)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water (3.4.1-27)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Steel external surfaces exposed to air - indoor uncontrolled (external), condensation (external), or air outdoor (external) (3.4.1-28)	Loss of material due to general corrosion	External Surfaces Monitoring	No	System Walkdown Program (B.2.32), and Supplementary Piping/Tank Inspection (B.2.28)	Consistent with GALL Report (See SER Section 3.4.2.1.2)
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-29)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Flow-Accelerated Corrosion (B.2.11), and Preventive Maintenance Activities – Main Turbine (B.2.49)	Consistent with GALL Report (See SER Section 3.4.2.1.3)
Steel piping, piping components, and piping elements exposed to air outdoor (internal) or condensation (internal) (3.4.1-30)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Supplemental Piping and Tanks Inspection Program (B.2.28)	Consistent with GALL Report (See SER Section 3.4.2.1.4)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel heat exchanger components exposed to raw water (3.4.1-31)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable (See SER Section 3.4.2.1.1)
Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water (3.4.1-32)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Stainless steel heat exchanger components exposed to raw water (3.4.1-33)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water (3.4.1-34)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Copper alloy > 15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water (3.4.1-35)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching Inspection Program (B.2.29)	Consistent with GALL Report
Gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water (3.4.1-36)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam (3.4.1-37)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	BWR Water Chemistry Program (B.2.2)	Consistent with GALL Report (See SER Section 3.4.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel bolting and external surfaces exposed to air with borated water leakage (3.4.1-38)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Not applicable	Not applicable to BWRs
Stainless steel piping, piping components, and piping elements exposed to steam (3.4.1-39)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable	Not applicable to BWRs
Glass piping elements exposed to air, lubricating oil, raw water, and treated water (3.4.1-40)	None	None	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.4.1-41)	None	None	No	None	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.4.1-42)	None	None	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.4.1-43)	None	None	No	Not applicable	Not applicable to SSES (See SER Section 3.4.2.1.1)
Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.4.1-44)	None	None	No	None	Consistent with GALL Report

The staff's review of the steam and power conversion systems component groups followed any one of several approaches. One approach, documented in SER Section 3.4.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and

require no further evaluation. Another approach, documented in SER Section 3.4.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.4.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the steam and power conversion systems components is documented in SER Section 3.0.3.

3.4.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.4.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the steam and power conversion systems components:

- BWR Water Chemistry Program
- Flow-Accelerated Corrosion (FAC) Program
- Bolting Integrity Program
- Condensate and Refueling Water Storage Tanks Inspection
- Chemistry Program Effectiveness Inspection
- Supplemental Piping/Tank Inspection
- Selective Leaching Inspection
- Buried Piping and Tanks Inspection Program
- System Walkdown Program

LRA Tables 3.4.2-1 through 3.4.2-10 summarizes AMRs for the steam and power conversion systems components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

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

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

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. This note indicates that the applicant was unable

to find a listing of some system components in the GALL Report; however, the applicant identified in the GALL Report a different component with the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

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

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the engineered safety features ESF components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.2.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsections that follow.

3.4.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.4.1, item 23, the applicant states for this line item cracking of stainless steel piping, piping components, and piping elements is addressed under the treated water environment in table item 3.4.1-13. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that the components under the this commodity group: stainless steel piping, piping components, and piping elements, are evaluated as exposed to treated water under line item 3.4.1-13. On the basis that this commodity group has been evaluated, the staff agreed with the applicant's treatment of this line item.

In LRA Table 3.4.1, items 24 and 25, the applicant states that there are no steel heat exchanger components and stainless steel components that are subject to AMR and exposed to treated (closed cycle cooling) water in the steam and power conversion system for SSES.

The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that no components under this commodity group exist in the Steam and Power Conversion System. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to SSES.

In LRA Table 3.4.1, items 26 and 27, the applicant states that there are no copper alloy components and heat exchanger tubes exposed to closed cycle cooling water in the steam and power system for SSES that are subject to AMR. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that no components under this commodity group exist in the Steam and Power Conversion System. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to SSES.

In LRA Table 3.4.1, items 31, 32, 33, and 34, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because only the main condenser in the steam and power conversion system contains steel or stainless steel components that are subject to AMR and exposed to raw water. The applicant further stated that no aging effects were identified that could affect the intended function of Isolated Condenser Treatment Method (ICTM) volume for these components. The staff reviewed the system intended function provided in LRA Section 2.3.4.4 and noted that the intended function is to support the MSIV leakage ICTM by providing hold-up and plate-out of fission products.

The staff found that, to maintain the intended function of plateout and holdup during post-accident conditions, the main condenser and main condenser complex components must remain intact. The staff noted that normal plant operations monitor condenser vacuum continuously to verify its integrity, and that the acceptable performance of the main condenser during normal plant operation is adequate assurance that it will perform the plateout and holdup post-accident function. Therefore, the staff agrees with the applicant's conclusion that no AMP is required to assure the post-accident intended function and that this aging effect is not applicable, and the staff finds that the corresponding AMR result line in the GALL Report is not applicable to SSES.

In LRA Table 3.4.1, item 36, the applicant states for this line item there are no gray cast iron piping, piping, components or piping elements that are subject to AMR and exposed to soil, treated water or raw water in the steam and power conversion system for SSES. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that no components under this commodity group exist in the Steam and Power Conversion System. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to SSES.

In LRA Table 3.4.1, item 40, the applicant states for this line item, there are no glass piping elements in the steam and power conversion system for SSES. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that no components under this commodity group exist in the Steam and Power Conversion System. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to SSES.

In LRA Table 3.4.1, item 42, the applicant states for this line item, indoor environments are considered to be uncontrolled. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that the components under the this commodity group: steel piping, piping components, and piping elements, are evaluated as exposed to uncontrolled air

under line item 3.4.1-28. On the basis that this commodity group has been evaluated, the staff agreed with the applicant's statement that this line item is not applicable.

In LRA Table 3.4.1, item 43, the applicant states for this line item, there are no components in the steam and power conversion system for SSES embedded in concrete. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that no components under this commodity group exist in the Steam and Power Conversion System. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to SSES.

3.4.2.1.2 Loss of material due to general corrosion

In Table 3.4.2-6, the LRA states that loss of material of MS system steel piping in an external environment of indoor air is managed by the Supplementary Piping/Tank Inspection Program.

During the audit, the staff noted that the applicant applied Note E to this item and referenced LRA Table 3.4-1, item 3.4.1-28 and GALL Report Volume 2, item VII.H-7. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M36, "External Surface Monitoring", the applicant proposed using the Supplementary Piping/Tank Inspection Program. The LRA also references footnote 0401, which states that the environment is an aggressive air/water interface in the suppression pool. The staff determined that in this environment, loss of material is due to crevice and pitting corrosion on the inside surface of SRV discharge piping at air/water interface in the suppression pool, and also, on the outside surface of SRV discharge piping at air/water interface in the suppression pool.

However, the discussion column of Table 3.4.1, line item 3.4.1-28 only credits the System Walkdown Program, and does not address the Supplementary Piping/Tank Inspection Program. The staff issued RAI 3.4.2.1-1 by letter dated July 23, 2008, to request the applicant to clarify this discrepancy.

Furthermore, for the same air/water interface environment, in some cases the LRA tables reference footnote "G" or "H" and in some cases, they reference footnote "E." RAI 3.4.2-1 also requested to clarify this discrepancy.

In its letter dated August 22, 2008, the applicant responded to RAI 3.4.2.1-1 by amending the LRA to include the following paragraph in the discussion column of Table 3.4.1, item 3.4.1-28:

> This item also includes loss of material due to pitting and crevice corrosion at air/water interfaces for carbon steel piping components in an indoor air environment. The Supplemental Piping/Tank Inspection is credited to detect and characterize loss of material for these components. A Note E is used.

On the basis that the applicant amended the LRA to resolve the discrepancy between Table 3.4.1, item 3.4.1-28 discussion column and Table 3.4.2-6, the staff finds the response acceptable.

Furthermore, the applicant stated that the footnote H was used incorrectly and that Note E should have been used as per the response provided in RAI 3.2.2.3.1-1 and documented in SER Section 3.2.2.3.1.

The staff reviewed the Supplementary Piping/Tank Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection is performed at very specific locations of air/water interface, and employs more conservative inspection techniques than the visual inspection of External Surfaces Monitoring Program, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

3.4.2.1.3 Wall Thinning due to Flow-Accelerated Corrosion

In its letter dated June 30, 2008, in response to RAI B2.11-1, the applicant stated that wall thinning due to flow-accelerated corrosion of steel main turbine casings in a treated water environment is managed by the Preventive Maintenance Activities – Main Turbine.

The staff noted that the applicant applied Note E to this item and referenced Table 3.4-1, item 3.4.1-29 and GALL Report Volume 2, item VIII.B2-4. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M17, "Flow-Accelerated Corrosion", the applicant proposed using the Preventive Maintenance Activities – Main Turbine Program.

The staff reviewed the Preventive Maintenance Activities – Main Turbine Program, which is an existing plant-specific program that will be enhanced to include the inspection of the high pressure turbine shell using visual inspection (VT-3 or equivalent) techniques and an ultrasonic examination for wall thickness. The staff evaluated the Preventive Maintenance Activities – Main Turbine Program and its evaluation is documented in SER Section 3.0.3.3.4. The staff finds the Preventive Maintenance Activities – Main Turbine acceptable to manage the aging effects of loss of material due to flow-accelerated corrosion because the turbine shell will be visually and volumetrically inspected in the presence of the turbine manufacturer representative, and the operating experience review did not indicate any wear on the turbine outer casing during significant modification work performed on these turbines over the last five years. On this basis, the staff finds that the Preventive Maintenance Activities – Main Turbine will adequately manage loss of material of steel turbine casing in a treated water environment during the period of extended operation.

3.4.2.1.4 Loss of material due to general, pitting and crevice corrosion

In Table 3.4.2-3, the LRA states that loss of material of condensate transfer and storage system steel valve bodies in an internal environment of ventilation is managed by the Supplementary Piping/Tank Inspection Program.

During the audit, the staff noted that the applicant applied Note E to this item and referenced LRA Table 3.4-1, item 3.4.1-30 and GALL Report Volume 2, item VIII.B1-6. The staff reviewed the AMR results lines that reference Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components", the applicant proposed using the Supplementary Piping/Tank Inspection Program.

The staff reviewed the Supplementary Piping/Tank Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection employs more conservative inspection techniques than only the visual inspection of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in an internal environment of ventilation.

SER Section 3.4.2.1 Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

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

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling
- reduction of heat transfer due to fouling
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- cracking due to SCC
- loss of material due to pitting and crevice corrosion
- loss of material due to pitting, crevice, and microbiologically-influenced corrosion
- loss of material due to general, pitting, crevice, and galvanic corrosion
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.4.2.2. The staff's review of the applicant's further evaluation follows.

3.4.2.2.1 Cumulative Fatigue Damage

LRA Section 3.4.2.2.1 states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

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

The staff reviewed LRA Section 3.4.2.2.2 against the following criteria in SRP-LR Section 3.4.2.2.2:

(1) LRA Section 3.4.2.2.2 addresses loss of material due to general, pitting, and crevice corrosion in piping, piping components, piping elements, tanks, and heat exchangers. The applicant stated that loss of material due to general, pitting, and crevice corrosion for steel piping components and tanks exposed to treated water in the Steam and Power Conversion System is managed by the BWR Water Chemistry Program. The BWR Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The Chemistry Program Effectiveness Inspection will provide a verification of the effectiveness of the BWR Water Chemistry Program to manage loss of material due to general, pitting, and crevice corrosion through examination of steel piping components and tanks exposed to treated water.

SRP-LR Section 3.4.2.2.2 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam. The existing AMP monitors and controls water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of selected components and susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff noted that the applicant combined components from LRA Table 3.4.1, item 2 with components in LRA Table 3.4.1, item 4 for the purpose of AMR. The staff finds this acceptable because the material, environment and aging effect for item 3.4.1-2 is the same as for item 3.4.2 4 except that the environment in item 3.4.1-2 is steam and in item 3.4.1-4 is liquid, and with regard to loss of material due to corrosion, the aging effects in a liquid and in a steam environment are identical for steel components. On this basis, the staff finds the application treatment of LRA Table item 3.4.1-2 as acceptable

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, determined that the BWR Water Chemistry Program is consistent with the GALL Report's recommendations for AMP XI.M2, "Water Chemistry," and provides mitigation for the aging effect of loss of material due to general, pitting, crevice, and galvanic corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found

that the Chemistry Program Effectiveness Inspection is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to general, pitting crevice, and galvanic corrosion, if it should occur in the selected components. Based on the applicant's use of a water chemistry program that provides mitigation of the aging effect and use of a one-time inspection to confirm effectiveness of the water chemistry program consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to general, pitting, crevice, and galvanic corrosion, in steel piping, piping components, piping elements, and tanks exposed to treated water or to steam in the feedwater system, the condensate storage and transfer system, the makeup demineralizer system, the makeup transfer and storage system, and the refueling water transfer and storage system to be acceptable.

The staff noted that the applicant designated line 3.4.1-3 of LRA Table 3.4.1 as "not applicable" because the AMR result applies only for PWRs. The staff reviewed the SRP-LR and confirmed that the corresponding AMR result in SRP-LR, Table 3.4-1, item 3, is applicable only for PWRs. On the basis that Susquehanna is a BWR, not a PWR, the staff finds the applicant's determination that LRA Table 3.4.1, item 3.4.1-3, is not applicable to be acceptable.

(2) LRA Section 3.4.2.2.2 addresses loss of material due to general, pitting, and crevice corrosion in piping, piping components, and piping elements exposed to lubricating oil. The applicant stated that this aging effect is not applicable because there are no steel components that are exposed to lubricating oil in the steam and power conversion system.

SRP-LR Section 3.4.2.2.2 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements exposed to lubricating oil. The existing AMP periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of lube oil chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed LRA Section 2.3.4 and verified that SSES does not have support systems within the scope of license renewal that contain the piping, piping components and piping elements fabricated from steel exposed to lubricating oil.

Based on the staff's review as described above and of LRA Section 3.4 found that there were no steel piping, piping components and piping elements exposed to lubricating oil internally or externally. On the basis of this review, the staff finds that SRP-LR Section 3.4.2.2.2 item 2 is not applicable to SSES.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.2 criteria. For those line items that apply to LRA Section 3.4.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion, and Fouling

The staff reviewed LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3.

LRA Section 3.4.2.2.3 addresses loss of material due to general, pitting, crevice, and microbiologically influenced corrosion (MIC), and fouling. The applicant stated that this aging effect is not applicable because the only steam and power conversion components exposed to raw water are the stainless steel tubes inside the main condenser.

SRP-LR Section 3.4.2.2.3 states that loss of material due to general, pitting, and crevice corrosion, and MIC and fouling may occur in steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that SSES has no steel piping, piping components, and piping elements exposed to raw water. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to SSES.

Based on the above, the staff concludes SRP-LR Section 3.4.2.2.3 criteria is not applicable.

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.4.2.2.4 against the following criteria in SRP-LR Section 3.4.2.2.4:

(1) LRA Section 3.4.2.2.4 addresses reduction of heat transfer due to fouling in heat exchanger tubes exposed to treated water. The applicant stated that this aging effect is not applicable because there are no heat exchanger tubes exposed to treated water in the steam and power conversion system that perform an intended function of heat transfer.

    SRP-LR Section 3.4.2.2.4 states that reduction of heat transfer due to fouling may occur in stainless steel and copper alloy heat exchanger tubes exposed to treated water. The existing AMP controls water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may not always be fully effective in precluding fouling; therefore, the GALL Report recommends that the effectiveness of water chemistry control programs should be verified to ensure that reduction of heat transfer due to fouling does not occur. A one-time inspection is an acceptable method to ensure that reduction of heat transfer does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the AMR Tables in LRA Section 3.4 and plant basis documents and found that there were no stainless steel and copper alloy heat exchanger components identified with a heat transfer function exposed to treated water. On the basis of this review, the staff finds that this SRP-LR Section is not applicable to SSES.

(2) LRA Section 3.4.2.2.4 addresses reduction of heat transfer due to fouling in heat exchanger tubes exposed to lubricating oil. The applicant stated that this aging effect is not applicable because there are no heat exchanger tubes exposed to lubricating oil in the steam and power conversion system.

SRP-LR Section 3.4.2.2.4 states that reduction of heat transfer due to fouling may occur in steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing AMP monitors and controls lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil chemistry may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that fouling does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control programs. A one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The staff reviewed the AMR Tables in LRA Section 3.4 and plant basis documents and found that there were no steel, stainless steel and copper alloy heat exchanger components identified with a heat transfer function exposed to lubricating oil. On the basis of this review, the staff finds that this SRP-LR Section is not applicable to SSES.

Based on the above, the staff concludes SRP-LR Section 3.4.2.2.4 criteria are not applicable.

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

The staff reviewed LRA Section 3.4.2.2.5 against the following criteria in SRP-LR Section 3.4.2.2.5:

(1) LRA Section 3.4.2.2.5 addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion in piping, piping components, and piping elements exposed to soil. The applicant stated that this aging effect is not applicable because there are no steel piping components or tanks exposed to soil in the steam and power conversion system.

SRP-LR Section 3.4.2.2.5 states that loss of material due to general, pitting, and crevice corrosion, and MIC may occur in steel (with or without coating or wrapping) piping, piping components, piping elements, and tanks exposed to soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion, and MIC.

The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components to ensure that loss of material does not occur.

The staff reviewed LRA Section 2.3.4 and verified that SSES does not have support systems within the scope of license renewal that contain steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to soil. The only steam and power conversion system components exposed to soil are stainless steel piping.

Based on the staff's review as described above and of LRA Section 3.4, the staff found that there were no steel piping, piping components, piping elements and tanks exposed to soil. On the basis of this review, the staff finds that SRP-LR Section 3.4.2.2.5.1 is not applicable to SSES.

(2) LRA Section 3.4.2.2.5 addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion in heat exchanger components exposed to lubricating oil. The applicant stated that this aging effect is not applicable because there are no steel heat exchanger components exposed to lubricating oil in the steam and power conversion system.

SRP-LR Section 3.4.2.2.5 states that loss of material due to general, pitting, and crevice corrosion, and MIC may occur in steel heat exchanger components exposed to lubricating oil. The existing AMP periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the AMR Tables in LRA Section 3.4 and plant basis documents and found that there were no steel heat exchanger components identified with a heat transfer function exposed to lubricating oil. On the basis of this review, the staff finds that this SRP-LR Section is not applicable to SSES.

Based on the above, the staff concludes SRP-LR Section 3.4.2.2.5 criteria are not applicable.

3.4.2.2.6 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.4.2.2.6 against the criteria in SRP-LR Section 3.4.2.2.6.

LRA Section 3.4.2.2.6 addresses cracking due to stress corrosion cracking (SCC). The applicant states that cracking due to SCC for stainless steel piping components exposed to treated water or steam in the Steam and Power Conversion Systems is managed by the BWR Water Chemistry Program. The BWR Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the BWR Water Chemistry Program to manage cracking due to SCC through examination of stainless steel piping components exposed to treated water or steam.

SRP-LR Section 3.4.2.2.6 states that cracking due to SCC may occur in stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60°C (140°F) and in stainless steel piping, piping components, and piping elements exposed to steam. The existing AMP monitors and controls water chemistry to manage the effects of cracking due to SCC. However, high concentrations of impurities in crevices and with stagnant flow conditions may cause SCC; therefore, the GALL Report recommends that the effectiveness of water chemistry control programs should be verified to ensure that SCC does not occur. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC does not occur and that component intended functions will be maintained during the period of extended operation.

The staff noted that the applicant combined components from LRA Table 3.4.1, item 3.4.1-14 with components in LRA Table 3.4.1, item 3.4.1-13, for the purpose of AMR. The applicant described this in the discussion column for LRA Table 3.4.1, item 3.4.1-14. The staff noted that the material, environment, aging effect and recommended AMPs for item 3.4.1-14 are the same as for item 3.4.1-13, except that the environment in item 3.4.1-13 is steam (vaporized treated water) and in item 3.4.1-14 is liquid (treated water) at temperature >60°C (>140°F). On the basis that the material, environment, aging effect and recommended AMPs are the the identical in LRA Table 3.4.1, items 3.4.1-13 and 3.4.1-14 (except for difference in liquid/vapor phase), the staff finds it acceptable for the applicant to address all components associated with these two lines under Table 3.4.1, item 3.4.1-13.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, determined that the BWR Water Chemistry Program is consistent with the GALL Report's recommendations for AMP XI.M2, "Water Chemistry," and provides mitigation for the aging effect of cracking due to SCC. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The applicant's CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and uses inspection techniques that are capable of detecting cracking due to SCC, if it should occur in the selected components. Based on the applicant's use of a chemistry program that provides mitigation of the aging effect and a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking due to SCC in stainless steel piping components exposed to treated water >60°C (>140°F) or to steam in the steam and power conversion system to be acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.6 criteria. For those line items that apply to LRA Section 3.4.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.7 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.7 against the following criteria in SRP-LR Section 3.4.2.2.7:

(1) LRA Section 3.4.2.2.7 addresses loss of material due to pitting and crevice corrosion in piping, piping components, piping elements, tanks, and heat exchanger components. The applicant states that there are no aging effects identified for aluminum piping components subject to AMR in the Steam and Power Conversion System. Loss of material due to pitting and crevice corrosion for stainless steel piping components and tanks, and copper alloy piping components, exposed to treated water in the Steam and Power Conversion System is managed by the BWR Water Chemistry Program. The BWR Water Chemistry Program manages aging effects through periodic monitoring and control of contaminants. The CPEI will provide a verification of the effectiveness of the BWR Water Chemistry Program to manage loss of material due to pitting and crevice corrosion through examination of stainless steel piping components and tanks, and copper alloy piping components, exposed to treated water.

SRP-LR Section 3.4.2.2.7 states that loss of material due to pitting and crevice corrosion may occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements and in stainless steel tanks and heat exchanger components exposed to treated water. The existing AMP monitors and controls water chemistry to manage the effects of loss of material due to pitting, and crevice corrosion. However, control of water chemistry may not preclude corrosion at locations with stagnant flow conditions; therefore, the GALL Report recommends that the effectiveness of water chemistry programs should be verified to ensure that corrosion does not occur. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff noted the applicant's statement that there are no aging effects identified for aluminum piping components subject to AMR in the steam and power conversion system. The staff issued RAI 3.4.2.2.7.1-1 by letter dated July 15, 2008, asking the applicant to clarify whether this statement means that there are no aluminum components in a treated water environment in the steam and power conversion system or that there are such components but no aging effects are identified for those components.

In a letter dated August 15, 2008, the applicant responded to RAI 3.4.2.2.7.1-1 by providing the following response:

There are no aluminum piping components that are in-scope for license renewal and that are exposed to a treated water environment in the steam and power conversion system. The only aluminum piping components that are in-scope for license renewal and that are in the steam and power conversion system are valve bodies in the MS system. These valve bodies are exposed internally to a dry air-gas environment and externally to indoor air environment as indicated in LRA Table 3.4.2-6.

The staff reviewed the applicant's response and the AMR results for the aluminum valve bodies in LRA Table 3.4.2-6. The staff's evaluation of these components is documented SER Table 3.4.1, item 3.4.1-44, and in SER Section 3.4.2.3. Because there are no

aluminum piping components in the steam and power conversion system that are in-scope for license renewal and in a treated water environment, the staff finds the applicant's response to be acceptable. The staff finds the applicant's response acceptable to have resolved the issue raised in RAI 3.4.2.2.7.1-1.

The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, determined that the BWR Water Chemistry Program is consistent with the GALL Report's recommendations for AMP XI.M2, "Water Chemistry," and provides mitigation for the aging effect of loss of material due to pitting and crevice corrosion. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to pitting or crevice corrosion, if it should occur in the selected components. Based on the applicant's use of a water chemistry program that provides mitigation of the aging effect and use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to pitting or crevice corrosion in stainless steel piping components and tanks and copper alloy piping components exposed to treated water in the steam and power conversion system to be acceptable.

(2) LRA Section 3.4.2.2.7 addresses loss of material due to pitting and crevice corrosion in piping, piping components, piping elements exposed to soil. The applicant states that loss of material due to pitting and crevice corrosion for stainless steel piping components exposed to soil is managed by the Buried Piping and Tanks Inspection Program.

SRP-LR Section 3.4.2.2.7 states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The applicant has indicated generic Note E for this line item which is "Consistent with NUREG-1801 item for material, environment, and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program." Because the GALL XI.M34, "Buried Piping and Tanks Inspection" Program does not discuss piping and tanks constructed from materials besides carbon steel, GALL calls out a plant-specific aging management program for this buried stainless steel program and specifies further evaluation. The staff reviewed the applicant's Buried Piping and Inspection Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.13 found that the Buried Piping Inspection Program is based on the applicant's plant-specific operating experience that uncoated stainless steel buried piping has not experienced degradation. However the applicant has conservatively added the buried stainless steel piping within the scope of this program to ensure that degradation has not occurred. The staff noted that a visual inspection that will be performed by the applicant on the buried stainless steel piping within 10 years of entering the period of extended operation will be capable of detecting age-related degradation as a result of loss of material, consistent with the GALL recommendations. The American Water Works Association standard for stainless steel

piping is AWWA C220, "Stainless Steel Piping." On the basis of its review, the staff finds the applicant has conservatively included stainless steel piping in the scope of this program to be inspected within 10 years of entering the period of extended operation and that a visual inspection of the external surface will be capable of detecting loss of material.

(3) LRA Section 3.4.2.2.7 addresses loss of material due to pitting and crevice corrosion in piping, piping components, and piping elements exposed to lubricating oil. The applicant stated that this aging effect is not applicable because there is no copper alloy piping, piping components, or piping elements that are exposed to lubricating oil in the steam and power conversion system.

SRP-LR Section 3.4.2.2.7 states that loss of material due to pitting and crevice corrosion may occur in copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing AMP periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed LRA Section 2.3.4 and verified that SSES does not have support systems within the scope of license renewal that contain the piping, piping components and piping elements fabricated from copper alloy exposed to lubricating oil.

Based on the staff's review of LRA Section 3.4 there were no copper alloy piping, piping components and piping elements exposed to lubricating oil internally or externally. On the basis of this review, the staff finds that SRP-LR Section 3.4.2.2.7 Item 3 is not applicable to SSES.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7 criteria. For those line items that apply to LRA Section 3.4.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8.

LRA Section 3.4.2.2.8 addresses loss of material due to pitting, crevice, and microbiologically influenced corrosion. The applicant stated that this aging effect is not applicable because there are no stainless steel piping, piping components, piping elements, or heat exchanger components exposed to lubricating oil in the steam and power conversion system.

SRP-LR Section 3.4.2.2.8 states that loss of material due to pitting and crevice corrosion, and MIC may occur in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. The existing AMP periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion; therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed LRA Section 2.3.4 and verified that SSES does not have support systems with-in the scope of license renewal that contain the piping, piping components and elements and heat exchanger components fabricated from stainless steel exposed to lubricating oil.

Based on the staff's review as described above and of LRA Section 3.4 and found that there were no stainless steel piping, piping components and elements and heat exchanger components exposed to lubricating oil internally or externally. On the basis of this review, the staff finds that SRP-LR Section 3.4.2.2.8 is not applicable to SSES.

Based on the above, the staff concludes SRP-LR Section 3.4.2.2.8 criteria are not applicable.

3.4.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

The staff reviewed LRA Section 3.4.2.2.9 against the criteria in SRP-LR Section 3.4.2.2.9.

LRA Section 3.4.2.2.9 addresses loss of material due to general, pitting, crevice, and galvanic corrosion. The applicant stated that this aging effect is not applicable because there are no steel heat exchanger components exposed to treated water in the steam and power conversion system.

SRP-LR Section 3.4.2.2.9 states that loss of material due to general, pitting, crevice, and galvanic corrosion may occur in steel heat exchanger components exposed to treated water. The existing AMP monitors and controls water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends that the effectiveness of water chemistry should be verified to confirm that corrosion does not occur. A one-time inspection of selected components and susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the AMR Tables in LRA Section 3.4 and found that there were no heat exchanger components exposed to treated water. On the basis of this review, the staff finds that this SRP-LR Section is not applicable to SSES.

Based on the above, the staff concludes SRP-LR Section 3.4.2.2.9 criteria are not applicable.

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.4.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.4.2-1 through 3.4.2-10, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.4.2-1 through 3.4.2-10, the applicant indicated, via notes F through J, which the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.4.2.3.1 Aging Management Review Results - Auxiliary Boiler System – LRA Table 3.4.2-1

The staff reviewed LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the auxiliary boiler system component groups. The staff determined that all AMR evaluation results in LRA Table 3.4.2-1 are consistent with the GALL Report.

3.4.2.3.2 Aging Management Review Results - Bypass Steam System – LRA Table 3.4.2-2

The staff reviewed LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the bypass steam system component groups.

LRA Table 3.4.2-2 summarizes the results of AMRs for bypass steam valve bodies constructed from carbon steel and exposed to indoor air (internal) and treated water (internal) for which the applicant proposed no aging effect and therefore no AMP is required.

The applicant has indicated that generic Note I is applicable for these items. Generic Note I is "Aging effect in NUREG-1801 for this component, material, and environment is not applicable." The applicant explains in plant-specific Note 0406 why there are no aging effects requiring management. Plant-specific Note 0406 states "The assumption is made for license renewal that the occurrence of any aging effects results in minimal impact to the overall volume and surface area associated with the MSIV Leakage ICTM functions of hold-up and plate-out (ICTM Volume), and does not adversely affect the successful performance of this component intended function. This assumption is supported by the fact that vacuum is maintained on the condenser

during normal plant operation, and any leakage that enters the condenser post-accident is subsequently released to the atmosphere. Any age-related degradation that impacts normal plant operations would be indicated by a loss of vacuum and be resolved well before any significant impact to the available volume and surface area is experienced (For example, Condenser leakage is typically tracked and reported as Off-gas Flow Rate in support of normal plant operation). Therefore, since the successful performance of the ICTM function will not be realistically prevented by any age-related degradation, there are no aging effects requiring management for any components of the steam systems if the only component intended function is ICTM Volume." The staff agrees that there will not be an aging mechanism for this material/environment combination because the materials of interest will not be exposed to the environment of indoor air except for brief periods of time.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.3 Aging Management Review Results - Condensate Transfer and Storage System – LRA Table 3.4.2-3

The staff reviewed LRA Table 3.4.2-3, which summarizes the results of AMR evaluations for the condensate transfer and storage system component groups.

In LRA Table 3.4.2-3, the applicant proposed to manage loss of material due to crevice and pitting corrosion of stainless steel tanks in an internal environment of ventilation at air/water interfaces by using the Supplementary Piping/Tank Inspection Program. The applicant referenced footnote "G" for this line item indicating that the environment is not in the GALL Report for this component and material combination.

The staff reviewed the Supplementary Piping/Tank Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.16. Because the Supplementary Piping/Tank Inspection is performed at very specific locations of air/water interface, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

In LRA Tables 3.4.2-3, the applicant proposed to manage cracking in copper alloy piping and piping components in an environment of treated water by using the BWR Water Chemistry Program, alone. The applicant cited generic Note G for these AMR results, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The staff issued RAI 3.2-3 by letter dated July 15, 2008, applicable for these AMR results and for similar AMR results in LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, and 3.3.2-25. The RAI asked the applicant to provide a technical justification as to why an inspection program, such as the CPEI is not needed to confirm that the BWR Water Chemistry Program is effective in preventing the aging effect.

In a letter dated August 15, 2008, the applicant responded to RAI 3.2-3 by providing the following response:

> For the five AMR results lines listed in LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3, where the material is copper alloy, the environment is treated water (internal), and the aging effect is cracking, verification of the effectiveness of the BWR Water Chemistry Program is needed. The CPEI will provide confirmation of the effectiveness of this program in managing the effects of aging, including cracking in susceptible materials.
>
> LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-3, 3.3.2-25, and 3.4.2-3 are revised to reflect these results.

The staff reviewed the applicant's response and the associated LRA changes. The staff reviewed the applicant's BWR Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.1, found that the BWR Water Chemistry Program provides mitigation for the aging effect of cracking due to stress corrosion cracking. The staff reviewed the applicant's Chemistry Program Effectiveness Inspection. The staff's evaluation of this program, which is documented in SER Section 3.0.3.1.10, found that the CPEI is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "*One-Time Inspection.*" The CPEI includes provisions for inspecting selected components in areas of low or stagnant flow and uses examination techniques that are capable of detecting cracking, if it should occur in the selected components. Because the BWR Water Chemistry Program provides mitigation and the CPEI provides detection of the aging effect if it should occur, the staff finds the applicant's proposed AMPs for managing the potential aging effect of cracking due to stress corrosion cracking in copper alloy piping and piping components exposed to treated water in the condensate transfer and storage system to be acceptable. On this basis, the staff finds that the issue raised in RAI 3.2-3 is resolved by the applicant's LRA changes.

LRA Table 3.4.2-3 summarizes the results of AMRs for the Condensate Transfer and Storage System for valve bodies tubing, and piping constructed from stainless steel and exposed to outdoor air (external) and ventilation (interior) and proposed no aging effect and therefore that no AMP is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." The staff confirmed that this environment is not in GALL for this component and material. The staff also agrees that there will not be aging mechanism for this material/environment combination and that no AMP is required. The staff noted that stainless steel is highly resistant to corrosion in dry atmospheres in the absence of corrosive species (which would be reflective of indoor uncontrolled air), as cited in Metals Handbook, Volumes 3 (p. 65) and 13 (p.555) (Ninth Edition, American Society for Metals International, 1980 and 1987). Components are not subject to moisture in a dry air environment (and indoor uncontrolled air would have limited humidity and condensation). Therefore, the staff finds that stainless steel in an indoor, uncontrolled air environment exhibits no aging effect, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.4 Aging Management Review Results - Condenser and Air Removal System – LRA Table 3.4.2-4

The staff reviewed LRA Table 3.4.2-4, which summarizes the results of AMR evaluations for the condenser and air removal system component groups.

In Table 3.4.2-4, the LRA states that for synthetic rubber flexible connections in treated water internal and indoor air external environments in the condenser and air removal system, there are no aging effects requiring management. In RAI 3.4.2.3-1 Part A, by letter dated July 23, 2008, the staff asked the applicant to justify why it had not identified any aging effects requiring management for these system-material-environment combinations. In RAI 3.4.2.3-1, Part B, the staff asked the applicant to identify the rubber material that is used to fabricate the flexible expansion joints in the CAR systems and to identify those material properties and aging effects that could be impacted by exposure of these rubber materials to the treated water and indoor air environments.

In its letter dated August 27, 2008, the applicant responded to the RAI 3.4.2.3-1 Part A, and stated that there were no aging effects identified as requiring management because no aging effects were considered to be of significance that would prevent the intended function in this application of maintaining the ICTM volume (isolated condenser treatment method) as defined in LRA Table 2.0-1 and discussed in LRA Section 2.3.4.4.

In its response to RAI Part B, the applicant stated that the materials that are used to fabricate acceptable replacements for the flexible expansion joints (condenser boots) in the Condenser and Air Removal System are neoprene-impregnated nylon, or nitrile-impregnated nylon. The applicant also stated that the material properties that could be impacted include hardening (loss of flexibility) and loss of strength. As a result of a further evaluation of the AMR for the Condenser and Air Removal System, the applicant determined that the rubber expansion joints (condenser boots) are subject to replacement on a specified time period in accordance with plant preventive maintenance activities. The applicant further stated that the expansion joints are, therefore, short-lived components and are not subject to AMR. The applicant amended the LRA to revise Section 3.4.2.1.4 to delete rubber material from the list of materials; and revised Table 3.4.2.1-4, to delete the commodity type rubber flexible connections (expansion joints) in treated water and air-indoor environments.

The staff reviewed the applicant response and noted that the expansion joints are replaced on a specified time period. SRP-LR Section 2.1.3.2.2, "Long-Lived", identifies long-lived passive structures and components as those that are not subject to periodic replacement based on specified time period. Therefore, staff finds that the rubber expansion joints that are replaced on a specified time period are considered short-lived components and are not subject to AMR and can be deleted from LRA Table 3.4.2.1-4. On this basis, the staff finds the applicant response acceptable and considers this issue closed.

LRA Table 3.4.2-4 summarizes the results of AMRs for the Condenser and Air Removal System carbon steel piping exposed to treated water (internal), condensers (inlet/outlet water boxes) condensers (tubesheet) and condensers (shell) exposed to indoor air (external) and condensers (inlet/outlet water boxes) condensers (tubesheet), condensers (tubes) and condensers (shell) exposed to raw water (internal) and condensers (tubesheet) and (tubes)

exposed to raw water (internal) and condensers (tubesheet) exposed to treated water (external) and stainless steel condensers tube plugs exposed to raw water and treated water (external) and exposed to indoor air (external) and treated water (internal). The applicant proposed that this material-environment combination has no aging effects requiring management and that no AMR is required.

The applicant has indicated that generic Note I is applicable for these items. Generic Note I 0406 is "Aging effect in NUREG-1801 for this component, material, and environment is not applicable." Note 0406 states: "The assumption is made for license renewal that the occurrence of any aging effects results in minimal impact to the overall volume and surface area associated with the MSIV Leakage ICTM functions of hold-up and plate-out (ICTM Volume), and does not adversely affect the successful performance of this component intended function. This assumption is supported by the fact that vacuum is maintained on the condenser during normal plant operation, and any leakage that enters the condenser post-accident is subsequently released to the atmosphere. Any age-related degradation that impacts normal plant operations would be indicated by a loss of vacuum and be resolved well before any significant impact to the available volume and surface area is experienced (For example, condenser in leakage is typically tracked and reported as Off-gas Flow Rate in support of normal plant operation). Therefore, since the successful performance of the ICTM function will not be realistically prevented by any age-related degradation, there are no aging effects requiring management for any components of the steam systems if the only component intended function is ICTM Volume."

The staff agrees that there will not be an aging mechanism for this material/environment combination because the materials of interest will not be exposed to the environment of indoor air except for brief periods of time and any degradation that would occur would be insignificant.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.5 Aging Management Review Results - Feedwater System – LRA Table 3.4.2-5

The staff reviewed LRA Table 3.4.2-5, which summarizes the results of AMR evaluations for the feedwater system component groups.

In LRA Table 3.4.2-5, the applicant stated that for steel piping and valve bodies in an environment of air-indoor external, there are no aging effects and no aging management program is required. The applicant has indicated that generic Note I and specific Note 413 are applicable for these items. Generic Note I is "Aging effect in NUREG-1801 for this component, material, and environment is not applicable." Note 0413 states: "External surface temperature for this component type is > 100°C (212°F), therefore no moisture is present to promote aging."

As noted from Corrosion Handbook by H.H.Uhlig, general corrosion is the result of a chemical or electrochemical reaction between a material and an aggressive environment. The staff further noted that at ordinary temperatures, oxygen and moisture are the primary factors for corrosion to form. Also, both oxygen and moisture must be present because oxygen alone or water free of oxygen does not corrode steel to any extent. The staff noted that the feedwater piping operating temperature is usually above 212°F, which is significantly above the ambient temperature inside the plant. The staff determined that at this temperature, moisture will not

collect on the external surfaces, but will evaporate and leave the surface dry. Based on this review, the staff finds that for feedwater system steel piping and valve bodies in an environment of indoor-air external, there are no aging effects because for corrosion to occur moisture must be present, and for piping external surface temperatures above 212°F, moisture will evaporate and leave the surface dry. Therefore, the staff finds that steel piping and valve bodies in the feedwater system, in an environment of air-indoor external, there are no aging effects and no aging management program is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.6 Aging Management Review Results - Main Steam System – LRA Table 3.4.2-6

The staff reviewed LRA Table 3.4.2-6, which summarizes the results of AMR evaluations for the MS system component groups.

In LRA Table 3.4.2-6, the applicant proposed to manage loss of material of carbon steel piping and valves in an internal environment of ventilation at air/water interfaces by using the Supplementary Piping/Tank Inspection Program. The applicant referenced footnote "G" for this line item indicating that the environment is not in the GALL Report for this component and material combination. The applicant also referenced footnote 0401 which indicates that loss of material is due to crevice and/or pitting corrosion on the inside surface of SRV discharge piping at air/water interface in the suppression pool, and also, on the outside surface of SRV discharge piping at air/water interface in the suppression pool.

The staff reviewed the Supplementary Piping/Tank Inspection Program, which uses a combination of volumetric and visual examination techniques to identify evidence of loss of material or lack thereof. The staff's evaluation of the Supplementary Piping/Tank Inspection Program is documented in SER Section 3.0.3.1.6. Because the Supplementary Piping/Tank Inspection is performed at very specific locations of air/water interface, and employs a combination of volumetric and visual inspection techniques, the staff finds that the Supplementary Piping/Tank Inspection Program will adequately manage the aging effects of loss of material in this aggressive environment.

LRA Table 3.4.2-6 summarizes the results of AMRs for the MS System line valve bodies and piping constructed from carbon steel and exposed to indoor air (external) and treated water (internal) and the applicant proposed that this material-environment combination has no aging effects requiring management and no AMR is required.

The applicant has indicated that generic Note I is applicable for these items. Generic Note I 0406 is "Aging effect in NUREG-1801 for this component, material, and environment is not applicable." Note 0406 states: "The assumption is made for license renewal that the occurrence of any aging effects results in minimal impact to the overall volume and surface area associated with the MSIV Leakage ICTM functions of hold-up and plate-out (ICTM Volume), and does not adversely affect the successful performance of this component intended function. This assumption is supported by the fact that vacuum is maintained on the condenser during normal plant operation, and any leakage that enters the condenser post-accident is subsequently released to the atmosphere. Any age-related degradation that impacts normal plant operations would be indicated by a loss of vacuum and be resolved well before any

significant impact to the available volume and surface area is experienced (For example, Condenser in leakage is typically tracked and reported as Off-gas Flow Rate in support of normal plant operation) .

Therefore, since the successful performance of the ICTM function will not be realistically prevented by any age-related degradation, there are no aging effects requiring management for any components of the steam systems if the only component intended function is ICTM Volume.

The staff agrees that there will not be an aging mechanism for this material/environment combination because the materials of interest will not be exposed to the environment of indoor air except for brief periods of time and any degradation that would occur would be insignificant.

LRA Table 3.4.2-6 summarizes the results of AMRs for MS valve bodies constructed from aluminum and exposed to indoor air (external) and for which the applicant proposed no aging effect and therefore no AMP is required.

The applicant has indicated that generic Note G is applicable for these items. Generic Note G is "Environment not in NUREG-1801 for this component and material." However, the staff noted that GALL Report Item VII.J-1 addresses this component, material and environment and states that for aluminum piping, piping components, and piping elements in an environment of air-indoor controlled (external), there are no aging effects and no aging management program required. Since the applicant is consistent with the GALL Report, the staff finds that for MS valve bodies constructed from aluminum and exposed to indoor air (external), there are no aging effects and therefore no AMP is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.7 Aging Management Review Results - Main Turbine System – LRA Table 3.4.2-7

The staff reviewed LRA Table 3.4.2-7, which summarizes the results of AMR evaluations for the main turbine system component groups.

LRA Table 3.4.2-7 summarizes the results of AMRs for the Main Turbine System turbine casings (low pressure) constructed from carbon steel and exposed to indoor air (external) and treated water (internal) and the applicant proposed that this material-environment combination has no aging effects requiring management and that no AMR is required.

The applicant has indicated that generic Note I 0406 is applicable for these items. Generic Note I is "Aging effect in NUREG-1801 for this component, material, and environment is not applicable." Note 0406 states: "The assumption is made for license renewal that the occurrence of any aging effects results in minimal impact to the overall volume and surface area associated with the MSIV Leakage ICTM functions of hold-up and plate-out (ICTM Volume), and does not adversely affect the successful performance of this component intended function. This assumption is supported by the fact that vacuum is maintained on the condenser during normal plant operation, and any leakage that enters the condenser post-accident is subsequently released to the atmosphere. Any age-related degradation that impacts normal plant operations would be indicated by a loss of vacuum and be resolved well before any

significant impact to the available volume and surface area is experienced (For example, Condenser in leakage is typically tracked and reported as Off-gas Flow Rate in support of normal plant operation).

Therefore, since the successful performance of the ICTM function will not be realistically prevented by any age-related degradation, there are no aging effects requiring management for any components of the steam systems if the only component intended function is ICTM Volume."

The staff agrees that there will not be an aging mechanism for this material/environment combination because the materials of interest will not be exposed to the environment of indoor air except for brief periods of time and any degradation that would occur would be insignificant.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.8 Aging Management Review Results - Makeup Demineralizer System – LRA Table 3.4.2-8

The staff reviewed LRA Table 3.4.2-8, which summarizes the results of AMR evaluations for the makeup demineralizer system component groups. The staff determined that all AMR evaluation results in LRA Table 3.4.2-8 are consistent with the GALL Report.

3.4.2.3.9 Aging Management Review Results - Makeup Transfer and Storage System – LRA Table 3.4.2-9

The staff reviewed LRA Table 3.4.2-9, which summarizes the results of AMR evaluations for the makeup transfer and storage system component groups. The staff determined that all AMR evaluation results in LRA Table 3.4.2-9 are consistent with the GALL Report.

3.4.2.3.10 Aging Management Review Results - Refueling Water Transfer and Storage System – LRA Table 3.4.2-10

The staff reviewed LRA Table 3.4.2-10, which summarizes the results of AMR evaluations for the refueling water transfer and storage system component groups. The staff determined that all AMR evaluation results in LRA Table 3.4.2-10 are consistent with the GALL Report.

3.4.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the steam and power conversion systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5 Aging Management of Containments, Structures, and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the containments, structures, and components supports components and component groups of:

- Primary Containment
- Reactor Building
- Engineered Safeguards Service Water Pumphouse and Spray Pond
- Circulating Water Pumphouse and Water Treatment Building
- Control Structure
- Diesel Generator 'A, B, C, And D' Building
- Diesel Generator 'E' Building
- Turbine Building
- Yard Structures
- Bulk Commodities

3.5.1 Summary of Technical Information in the Application

LRA Section 3.5 provides AMR results for the containments, structures, and components supports components and component groups. LRA Table 3.5.1, "Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of the GALL Report," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the containments, structures, and components supports components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry OE in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry OE included a review of the GALL Report and OE issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the containments, structures, and components supports components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.5.2.1.

In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.5.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.5.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.5.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's OE to verify the applicant's claims.

Table 3.5-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.5 and addressed in the GALL Report.

Table 3.5-1 Staff Evaluation for Containments, Structures, and Component Supports in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
BWR Concrete and Steel (Mark I, II, and III) Containments					
Concrete elements: walls, dome, basemat, ring girder, buttresses, containment (as applicable) (3.5.1-1)	Aging of accessible and inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	ISI (IWL) and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater if environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes	ISI (IWL) Program (B.2.35)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1.1)
Concrete elements; All (3.5.1-2)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Not applicable	Not applicable to SSES for further evaluation (See SER Section 3.5.2.2.1.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete elements: foundation, sub-foundation (3.5.1-3)	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program If a de-watering system is relied upon to control erosion of cement from porous concrete subfoundations, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Not applicable	Not applicable to SSES for further evaluation (See SER Section 3.5.2.2.1.2)
Concrete elements: dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable) (3.5.1-4)	Reduction of strength and modulus of concrete due to elevated temperature	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to SSES (See SER Section 3.5.2.2.1.3)
Steel elements: drywell; torus; drywell head; embedded shell and sand pocket regions; drywell support skirt; torus ring girder; downcomers; liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor, suppression chamber (as applicable) (3.5.1-5)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes	ISI (IWE) Program (B.2.34), and Containment Leakage Rate Test Program (B.2.37)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1.4)
Steel elements: steel liner, liner anchors, integral attachments (3.5.1-6)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes	ISI (IWE) Program (B.2.34), and Containment Leakage Rate Test Program (B.2.37)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1.4)
Prestressed containment tendons (3.5.1-7)	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	Not applicable	Not applicable to SSES (See SER Section 3.5.2.1.1 and 3.5.2.2.1.5)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel elements: vent line, vent header, vent line bellows; downcomers; (3.5.1-8)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 4.6 and 3.5.2.2.1.6
Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-9)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1.6 and section 4.6)
Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds (3.5.1-10)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examinations/ evaluations for bellows assemblies and dissimilar metal welds.	Yes	Not applicable	Not applicable to SSES for further evaluation (See SER Section 3.5.2.2.1.7)
Stainless steel vent line bellows, (3.5.1-11)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examination/ evaluation for bellows assemblies and dissimilar metal welds.	Yes	Not applicable	Not applicable to SSES (See SER Section 3.5.2.2.1.7)
Steel, stainless steel elements; dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-12)	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks	Yes	Not applicable	Not Applicable for further evaluation (See SER Section 3.5.2.2.1.8)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel elements, dissimilar metal welds: torus; vent line; vent header; vent line bellows; downcomers (3.5.1-13)	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks	Yes	Not applicable	Not Applicable for further evaluation (See SER Section 3.5.2.2.1.8)
Concrete elements: dome, wall, basemat ring girder, buttresses, containment (as applicable) (3.5.1-14)	Loss of material (scaling, cracking, and spalling) due to freeze-thaw	ISI (IWL). Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes	Not applicable	Not applicable to SSES for further evaluation (See SER Section 3.5.2.2.1.9)
Concrete elements: walls, dome, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable). (3.5.1-15)	Cracking due to expansion and reaction with aggregate; increase in porosity, permeability due to leaching of calcium hydroxide	ISI (IWL) for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R.	Yes	Not applicable	Not applicable to SSES for further evaluation (See SER Section 3.5.2.2.1.10)
Seals, gaskets, and moisture barriers (3.5.1-16)	Loss of sealing and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	ISI (IWE) and 10 CFR Part 50, Appendix J	No	ISI (IWE) Program (B.2.34)	Consistent with GALL Report, (See SER Section 3.5.2.1)
Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms (3.5.1-17)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanisms	10 CFR Part 50, Appendix J and plant Technical Specifications	No	ISI (IWE) Program (B.2.34), Containment Leakage Rate Test Program (B.2.37)	Consistent with GALL Report, (See SER Section 3.5.2.1)
Steel penetration sleeves and dissimilar metal welds; personnel airlock, equipment hatch and CRD hatch (3.5.1-18)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	ISI (IWE) Program (B.2.34), and Containment Leakage Rate Test Program (B.2.37)	Consistent with GALL Report, (See SER Section 3.5.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements: stainless steel suppression chamber shell (inner surface) (3.5.1-19)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable	Not applicable (See SER Section 3.5.2.2.1.7)
Steel elements: suppression chamber liner (interior surface) (3.5.1-20)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	ISI (IWE) Program (B.2.34), Containment Leakage Rate Test Program (B.2.37), and BWR Water Chemistry Program (B.2.2)	Consistent with the GALL Report, (See SER Section 3.5.2.1)
Steel elements: drywell head and downcomer pipes (3.5.1-21)	Fretting or lock up due to mechanical wear	ISI (IWE)	No	ISI (IWE) Program (B.2.34)	Consistent with the GALL Report, (See SER Section 3.5.2.1)
Prestressed containment: tendons and anchorage components (3.5.1-22)	Loss of material due to corrosion	ISI (IWL)	No	Not applicable	Not applicable to SSES (See SER Section 3.5.2.1.1)
Safety-Related and Other Structures; and Component Supports					
All Groups except Group 6: interior and above grade exterior concrete (3.5.1-23)	Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.1)
All Groups except Group 6: interior and above grade exterior concrete (3.5.1-24)	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack	Structures Monitoring Program	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
All Groups except Group 6: steel components: all structural steel (3.5.1-25)	Loss of material due to corrosion	Structures Monitoring Program. If protective coatings are relied upon to manage the effects of aging, the Structures Monitoring Program is to include provisions to address protective coating monitoring and maintenance.	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.1)
All Groups except Group 6: accessible and inaccessible concrete: foundation (3.5.1-26)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Structures Monitoring Program. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Sections 3.5.2.2.2.1 and 3.5.2.2.2.2.1)
All Groups except Group 6: accessible and inaccessible interior/exterior concrete (3.5.1-27)	Cracking due to expansion due to reaction with aggregates	Structures Monitoring Program. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Sections 3.5.2.2.2.1 and 3.5.2.2.2.2.2)
Groups 1-3, 5-9: All (3.5.1-28)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Sections 3.5.2.2.2.1 and 3.5.2.2.2.2.3)
Groups 1-3, 5-9: foundation (3.5.1-29)	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Sections 3.5.2.2.2.1 and 3.5.2.2.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 4: radial beam seats in BWR drywell; RPV support shoes for PWR with nozzle supports; steam generator supports (3.5.1-30)	Lock-up due to wear	ISI (IWF) or Structures Monitoring Program	Yes	ISI (IWF) Program (B.2.36) and/or Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.1)
Groups 1-3, 5, 7-9: below-grade concrete components, such as exterior walls below grade and foundation (3.5.1-31)	Increase in porosity and permeability, cracking, loss of material (spalling, scaling), aggressive chemical attack; cracking, loss of bond, and loss of material (spalling, scaling), corrosion of embedded steel	Structures Monitoring Program; examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.2.4)
Groups 1-3, 5, 7-9: exterior above and below grade *reinforced* concrete foundations (3.5.1-32)	Increase in porosity and permeability, and loss of strength *due to leaching of* calcium hydroxide	Structures Monitoring Program for accessible areas. *None for inaccessible* areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program (B.2.39)	Not applicable to SSES for further evaluation (See SER Section 3.5.2.2.2.2.5)
Groups 1-5: concrete (3.5.1-33)	Reduction of strength and modulus due to elevated temperature	A plant-specific aging management program is to be evaluated	Yes	Not applicable	Not applicable to SSES for further evaluation (See SER Section 3.5.2.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: Concrete; all (3.5.1-34)	Increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack; cracking, loss of bond, loss of material due to corrosion of embedded steel	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes	Water-Control Structures Inspection Program (B.2.40)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.4.1)
Group 6: exterior above and below grade concrete foundation (3.5.1-35)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes	Water-Control Structures Inspection Program (B.2.40), and Structures Monitoring Program (B.2.39)	Consistent with GALL Report, (See SER Sections 3.5.2.1.5 and 3.5.2.2.2.4.2)
Group 6: all accessible and inaccessible reinforced concrete (3.5.1-36)	Cracking due to expansion/reaction with aggregates	Accessible areas: Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Water-Control Structures Inspection Program (B.2.40)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.4.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: exterior above and below grade reinforced concrete foundation interior slab (3.5.1-37)	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	For accessible areas, Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Water-Control Structures Inspection Program (B.2.40)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.4.3)
Groups 7, 8: tank liners (3.5.1-38)	Cracking due to SCC; loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes	Not applicable	Not Applicable, which recommends further evaluation (See SER Section 3.5.2.2.2.5)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-39)	Loss of material due to general and pitting corrosion	Structures Monitoring Program	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.6)
Building concrete at locations of expansion and grouted anchors; grout pads for support base plates (3.5.1-40)	Reduction in concrete anchor capacity due to local concrete degradation, service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.6)
Vibration isolation elements (3.5.1-41)	Reduction or loss of isolation function, radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Yes	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2.6)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds (3.5.1-42)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	None	Not applicable (See SER Section 3.5.2.2.2.7)
Groups 1-3, 5, 6: all masonry block walls (3.5.1-43)	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	No	Masonry Wall (B.2.38) and Fire Protection (B.2.16) Programs	Consistent with GALL Report, (See SER Section 3.5.2.1.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: elastomer seals, gaskets, and moisture barriers (3.5.1-44)	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	No	Structures Monitoring Program (B.2.39) and/or Fire Protection Program (B.2.16)	Consistent with GALL Report, (See SER Section 3.5.2.1)
Group 6: exterior above and below grade concrete foundation; interior slab (3.5.1-45)	Loss of material due to abrasion, cavitation	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance	No	Water Control Structures Inspection Program (B.2.40)	Consistent with GALL Report
Group 5: fuel pool liners (3.5.1-46)	Cracking due to SCC; loss of material due to pitting and crevice corrosion	Water Chemistry and monitoring of spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.	No	BWR Water Chemistry Program (B.2.2) and monitoring of spent fuel pool water level in accordance with Technical Specifications and Leak Chase Channels Monitoring Activities (B.2.47).	Consistent with GALL Report, (See SER Section 3.5.2.1)
Group 6: all metal structural members (3.5.1-47)	Loss of material due to general (steel only), pitting and crevice corrosion	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance. If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included.	No	Water Control Structures Inspection Program (B.2.40)	Consistent with GALL Report, (See SER Section 3.5.2.1.3)
Group 6: earthen water control structures - dams, embankments, reservoirs, channels, canals, and ponds (3.5.1-48)	Loss of material, loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs	No	Water-Control Structures Inspection Program (B.2.40)	Consistent with GALL Report, (See SER Section 3.5.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-49)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and ISI (IWF)	No	BWR Water Chemistry Program (B.2.2) and IWF Program (B.2.36)	Consistent with GALL Report, (See SER Section 3.5.2.1)
Groups B2, and B4: galvanized steel, aluminum, stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-50)	Loss of material due to pitting and crevice corrosion	Structures Monitoring Program	No	Structures Monitoring Program (B.2.39)	Consistent with GALL Report, (See SER Section 3.5.2.1.4)
Group B1.1: high strength low-alloy bolts (3.5.1-51)	Cracking due to SCC; loss of material due to general corrosion	Bolting Integrity	No	Bolting Integrity Program (B.2.12)	Not applicable to SSES (See SER Section 3.5.2.1.1)
Groups B2, and B4: sliding support bearings and sliding support surfaces (3.5.1-52)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Structures Monitoring Program	No	Not applicable	Not applicable to SSES (See SER Section 3.5.2.1.1)
Groups B1.1, B1.2, and B1.3: support members: welds; bolted connections; support anchorage to building structure (3.5.1-53)	Loss of material due to general and pitting corrosion	ISI (IWF)	No	IWF Program (B.2.36)	Consistent with GALL Report, (See SER Section 3.5.2.1)
Groups B1.1, B1.2, and B1.3: constant and variable load spring hangers; guides; stops; (3.5.1-54)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	ISI (IWF) Program (B.2.36)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, galvanized steel, and aluminum support members; welds; bolted connections; support anchorage to building structure (3.5.1-55)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Not applicable	Not applicable to BWRs
Groups B1.1, B1.2, and B1.3: sliding surfaces (3.5.1-56)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	Not applicable	Not applicable to SSES (See SER Section 3.5.2.1.1)
Groups B1.1, B1.2, and B1.3: vibration isolation elements (3.5.1-57)	Reduction or loss of isolation function, radiation hardening, temperature, humidity, sustained vibratory loading	ISI (IWF)	No	Not applicable	Not applicable to SSES (See SER Section 3.5.2.1.1)
Galvanized steel and aluminum support members; welds; bolted connections; support anchorage to building structure exposed to air - indoor uncontrolled (3.5.1-58)	None	None	No	None	Consistent with GALL Report
Stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-59)	None	None	No	None	Consistent with GALL Report

The staff's review of the containments, structures, and components supports component groups followed any one of several approaches. One approach, documented in SER Section 3.5.2.1, reviewed AMR results for components that the applicant indicated are

consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.5.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.5.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the containments, structures, and components supports components is documented in SER Section 3.0.3.

3.5.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.5.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the containments, structures, and component supports components:

- BWR Water Chemistry Program
- Crane Inspection Program
- Fire Protection Program
- Inservice Inspection (ISI) Program - IWE
- Inservice Inspection (ISI) Program - IWL
- Inservice Inspection (ISI) Program - IWF
- Containment Leakage Rate Test Program
- Masonry Wall Program
- Structures Monitoring Program
- RG 1.127 Water-Control Structures Inspection
- Leak Chase Channel Monitoring Activities

LRA Tables 3.5.2-1 through 3.5.2-10 summarize AMRs for the containments, structures, and components supports components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

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

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

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

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

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation follows.

3.5.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.5.1, items 22, 51, 52, 56, and 57 are identified as "Not Applicable" since the component, material, and environment combination does not exist at SSES. For each of these line items, the staff reviewed the LRA and the applicant's supporting documents, and confirmed the applicant's claim that the component, material, and environment combination does not exist at SSES. Because SSES does not have the component, material, and environment combination for these Table 1 line items, the staff finds that these AMRs are not applicable to SSES.

3.5.2.1.2 Cracking due to restraint shrinkage, creep, and aggressive environment.

In the discussion section of LRA Table 3.5.1, item 3.5.1-43, the applicant stated that cracking due to restraint shrinkage, creep, and aggressive environment is managed by the Masonry Wall Program. During the review, the staff noted that aging management program for the AMR results line that points to LRA Table 3.5.1, item 3.5.1-43, for five groups the applicant included a reference to Note E and plant-specific Note 516, which states "masonry walls with a fire barrier intended function receive additional inspection as part of the fire protection program."

The staff reviewed the AMR results lines referenced to Note E, plant-specific Note 516, and determined that the component type, material, environment, and aging effect are consistent

with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S5, "Masonry Wall Program," the applicant has proposed using the Fire Protection Program. The applicant stated that the AMR result line items that reference LRA Table 3.5.1 item 3.5.1-43, are also listed as fire barriers that are in the scope for 10 CFR 54.4(a)(2) criterion, and therefore, the Fire Protection Program was also credited. The Fire Protection Program and Masonry Wall Program are performing visual inspections on a periodic basis to manage cracking due to restraint shrinkage, creep, and aggressive environments. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the Fire Protection Program in conjunction with the Masonry Wall Program to be acceptable.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERMs adequately, as recommended by the GALL Report.

3.5.2.1.3 Loss of material due to general (steel only), pitting and crevice corrosion

In the discussion section of LRA Table 3.5.1, item 3.5.1-47, the applicant stated that loss of material due to general, pitting, and crevice corrosion is managed by the Structures Monitoring Program. During the review, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-47, for 16 groups the applicant included a reference to Note E and plant-specific Note 526, which states "component is different, but consistent with NUREG-1801 item for material, environment, and aging effect, SSES operating experience has shown of water accumulating in manholes. Therefore, aging mechanisms pertaining to raw water environments are also applicable within manholes, valve vaults, and instrument pits."

The staff reviewed the AMR results lines referenced to Note E, plant-specific Note 526, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," the applicant has proposed using the Structures Monitoring Program (SER Section 3.0.3.2.17). However, the AMR result line items that reference LRA Table 3.5.1, item 3.5.1-47, are structural steel members in the Water-Control Structure. However, the Water-Control Structure is in the scope for Structures Monitoring Program and the Structures Monitoring Program performs visual inspections to manage loss of material due to general, pitting, and crevice corrosion. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the Structures Monitoring Program to be acceptable.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERMs adequately, as recommended by the GALL Report.

3.5.2.1.4 Loss of Material Due to General and Pitting Corrosion

In the discussion section of LRA Table 3.5.1, item 3.5.1-50, the applicant stated that loss of material due to pitting, and crevice corrosion is managed by the Structures Monitoring Program. During the review, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-50, for two groups the applicant included a reference to Note E.

The staff reviewed the AMR results lines referenced to Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S6, "Structures Monitoring Program," the applicant has proposed using the ASME Section XI, Subsection IWF. However, the AMR result line items that reference LRA Table 3.5.1, item 3.5.1-50, are galvanized steels in the component and piping support members, which are in the scope for ASME Section XI, Subsection IWF and not in the Structures Monitoring Program. The ASME Section XI, Subsection IWF and the Structures Monitoring Program perform visual inspections to manage loss of material due to pitting, and crevice corrosion. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the ASME Section XI, Subsection IWF to be acceptable.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AEM adequately, as recommended by the GALL Report.

3.5.2.1.5 Loss of material (spalling, scaling) and cracking due to freeze-thaw

In the discussion section of LRA Table 3.5.1, item 3.5.1-35, the applicant stated: loss of material (spalling, scalling) and cracking due to freeze-thaw of group 6 exposed to raw water is managed by Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants. During the review, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-35, for three groups the applicant included a reference to Note E and plant-specific Note 503, which states "the GALL item for freeze-thaw does not list exposed to raw water environment for water control structures. Freeze-thaw may be possible near the water line. This environment is both exposed to raw water; therefore environment is considered a match. The identified AMP is used to manage aging effects for the period of extended operation."

The staff reviewed the AMR results lines referenced to Note E, plant-specific Note 503, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" the applicant has proposed using the Structures Monitoring Program for Table 3.5.1, item 3.5.1-35, which is concrete exposed to raw water environment. Since, the Water-Control Structure is in the scope for Structures Monitoring Program and the Structures Monitoring Program performs visual inspections to manage loss of material (spalling, scalling) and cracking due to freeze-thaw, the staff finds the applicant's use of the Structures Monitoring Program to be acceptable.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AEM adequately, as recommended by the GALL Report.

SER Section 3.5.2.1 Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with the AMRs Therefore, the staff concludes that

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

3.5.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

3.5.2.2.1 PWR and BWR Containments

Aging of Inaccessible Concrete Areas. The applicant stated in LRA Section 3.5.2.2.1.1 that the loss of material and change in material properties due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel in inaccessible areas of concrete and steel containments are not aging effects requiring management at SSES because (1) groundwater analyses confirm that the SSES site groundwater is not aggressive, and (2) the design of the SSES containment concrete in accordance with ACI 318-71 and construction in accordance with ACI 301-72 enhance the resistance to chemical attack through the use of dense concrete with low permeability, and generally prevent corrosion of embedded steel from occurring.

The staff reviewed LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1, which states that increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in inaccessible areas of concrete and steel containments. The existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. The SSES ISI Program – IWL described in LRA Section B.2.35 is an existing program that is consistent with all elements of GALL AMP XI.S2, "ASME Section XI, Subsection IWL". The staff's review of the applicant's ISI Program – IWL is documented in SER Section 3.0.3.1.20.

SRP-LR Section 3.5.2.2.1.1 also states that the GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if the environment is aggressive. To ensure non-aggressive groundwater chemistries, the GALL Report suggests the periodic groundwater inspection for chlorides, sulfates, and pH. The staff noted that the applicant's groundwater inspections are performed by the applicant's Structures Monitoring Program described in LRA Section B.2.39. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.17.

The staff has reviewed the LRA and some associated on-site documents. In addition to the sampling results from 2004 and 2005 presented in the LRA, which indicated groundwater pH minimum value of 5.9, chloride content maximum value of 26 ppm, and sulfate content maximum value of 96 ppm, the staff also checked SSES chemical analysis of groundwater at WW-2 (outside of the Emergency Diesel Generator Building) performed in 2006 and 2007, and found average values for pH 6.11 and 6.13, chloride 23.1 ppm and 40.4 ppm, and sulfate 43.2 ppm and 54.6 ppm, respectively. The staff confirmed that the below-grade environment at SSES is non-aggressive (Chlorides < 500 ppm, Sulfates <1500 ppm, and pH > 5.5).

The staff noticed that SSES concrete is designed in accordance with American Concrete Institute (ACI) 318-71 and constructed in accordance with ACI 301-72. The staff confirmed that concrete constructed to these criteria has a low water-to-cement ratio of less than 0.50 and an adequate air entrainment between 3 and 6%, which is equivalent to ACI 201.2R-77 recommendation on water-to-cement ratio for protecting concrete from chemical attack and

recommendation on air contents for resisting freezing and thawing. Therefore, the staff agreed that SSES concrete provides a good quality dense concrete with a low permeability, which meets the intent of ACI 201.2R-77.

The staff also noted that visual examinations in 2000 revealed surface cracking on the containment exterior and discussed it with the applicant's technical personnel. The applicant provided documentation showing that the cracking is less than the allowable values per ACI 224R "Control of Cracking in Concrete Structures", Table 4.1 and acceptable per its appropriate plant-specification. The staff further noted that the plant-specific operating experience did not reveal any significant degradation requiring further evaluation. The absence of concrete aging effects is confirmed under the applicant's ISI Program – IWL.

On the basis of its review, the staff finds that the increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not plausible aging effects at SSES because (1) the plant-specific operating experience did not reveal any degradation not bounded by industry experience, (2) the concrete being constructed meets the intent of ACI 201.2R for durability with a high cement, low water/cement ratio, and (3) the inspection frequency of groundwater chemistries under the applicant's Structures Monitoring Program agrees with the recommendation of the GALL Report for groundwater monitoring. Therefore, the staff finds that no further evaluation is required.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.1. For those line items that apply to LRA Section 3.5.2.2.1.1, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracks and Distortion due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking and Differential Settlement due to Erosion of Porous Concrete Subfoundations, if Not Covered by Structures Monitoring Program. The applicant stated in LRA Section 3.5.2.2.1.2 that the cracks and distortion due to increased stress levels from settlement, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations are not aging effects requiring management at SSES because (1) SSES does not employ a de-watering system in any of the site structures for control of settlement, (2) the primary containment base foundation slabs rest on competent bedrock and no settlement has been experienced, and (3) the primary containment base foundation slabs are not constructed of porous concrete below-grade and are not subject to flowing water.

The staff reviewed LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2, which states that the cracks and distortion due to increased stress levels from settlement could occur in concrete and steel containments. Also, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in all types of containments. The existing program relies on the structures monitoring program to manage these aging effects. SRP-LR Section 3.5.2.2.1.2 also states that the GALL Report recommends no further evaluation if this activity is within the scope of the applicant's structures monitoring program.

The SSES Structures Monitoring Program described in LRA Section B.2.39 is an existing program that is consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program." The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.17. The staff noted that the applicant conservatively elected to use the Structural Monitoring Program to monitor the above-grade exposed containment concrete for the aging effect of cracking and distortion due to settlement.

On the basis of its review, the staff finds that cracks and distortion due to increased stress levels from settlement, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations are not plausible aging effects to SSES because the conditions necessary for the aging effects, such as soil environment and flowing water environment, do not exist. The staff also finds that the Structures Monitoring Program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage cracks and distortion due to increased stress levels from settlement, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations. Therefore, the staff finds that no further evaluation is required.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.2. For those line items that apply to LRA Section 3.5.2.2.1.2, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature. The applicant stated in LRA Section 3.5.2.2.1.3 that during normal operation, containment concrete general area temperatures do not exceed 150°F and local area temperatures do not exceed 200°F.

The staff reviewed LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3, which states that reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR concrete and steel containments. The GALL Report recommends further evaluation of a plant-specific aging management program if any portion of the concrete containment components exceeds specified temperature limits, i.e., general area temperature greater than 66°C (150°F) and local area temperature greater than 93°C (200°F).

The staff reviewed the LRA and noted that no portion of the concrete containment components at SSES exceeds the specified temperature limits, which are 150°F for general area and 200 °F for local area. On the basis of its review, the staff finds that reduction of strength and modulus of concrete due to elevated temperatures are not applicable aging effects to SSES because the conditions necessary for the aging effects, such as elevated temperatures, do not exist. Therefore, the staff finds that no further evaluation is required.

Loss of Material due to General, Pitting and Crevice Corrosion. The applicant stated in LRA Section 3.5.2.2.1.4 that the loss of material due to general, pitting and crevice corrosion is not a significant aging effect at SSES because (1) the design of the SSES containment concrete in accordance with ACI 318-71 and construction in accordance with ACI 301-72 provide a good quality dense concrete with a low permeability, (2) the SSES concrete containments are located within the Reactor Buildings and are protected from weather, and (3) the design of containment liner is not conducive for capturing moisture between the carbon steel liner and concrete containment wall, as well as between the liner and drywell floor.

The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4, which states that loss of material due to general, pitting and crevice corrosion could occur in steel elements of accessible and inaccessible areas for all types of PWR and BWR containments. SRP-LR Section 3.5.2.2.1.4 further states that the existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. The SSES ISI Program – IWE, described in LRA Section B.3.34, and the Containment Leakage Rate Test Program, described in LRA Section B.3.37, are existing programs that are consistent with all elements of GALL AMP XI.S1, "ASME Section XI, Subsection IWE", and GALL AMP XI.S4, "10 CFR Part 50, Appendix J", respectively. The staff's reviews of the ISI Program – IWE and Containment Leakage Rate Test Program are documented in SER Section 3.0.3.1.19 and SER Section 3.0.3.1.22, respectively. SRP-LR Section 3.5.2.2.1.4 also states that the GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if corrosion is significant.

The staff reviewed the LRA and some associated on-site documents and interviewed the applicant's technical staff. During the on-site review, the staff noticed that general visual examinations of containment liners and penetrations have revealed flaking, discoloration, light to heavy pitting and corrosion. The applicant provided documentation showing that deficiencies were evaluated and corrected if necessary in accordance with the ISI Program - IWE. The staff noted that there were no instances of Appendix J test failures due to causes other than valve or flange seat leakage. For these failures, all conditions were evaluated and corrected in accordance with the Containment Leakage Rate Test Program. The plant-specific operating experience did not reveal or indicate any significant degradation in inaccessible areas. The aging effect of loss of material due to general pitting and crevice corrosion for containment steel elements is monitored and managed under the ISI Program – IWE and Containment Leakage Rate Test Program.

On the basis of its review, the staff determines that loss of material due to general pitting and crevice corrosion is an aging effect for steel elements of accessible and inaccessible areas of containments. The staff finds that applicant's inspections and tests in accordance with the ISI Program – IWE and Containment Leakage Rate Test Program to manage loss of material due to general pitting and crevice corrosion are adequate because (1) the plant-specific operating experience did not reveal any degradation not bounded by industry experience, (2) the aging effect has been effectively monitored and managed under the aforementioned programs, and (3) the containment concrete in contact with the embedded containment liner at SSES was designed, constructed, and inspected in accordance with applicable ACI and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete; hence corrosion for inaccessible areas is not expected to be significant for SSES. Therefore, the staff agrees that no additional plant-specific program is required.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.4. For those line items that apply to LRA Section 3.5.2.2.1.4, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.1.5 against the criteria in SRP-LR Section 3.5.2.2.1.5

SSES Containments are designed and constructed as reinforced concrete structures, not prestressed concrete structures. Therefore, loss of prestress forces due to relaxation, shrinkage, creep and elevated temperature is not an aging effect applicable to SSES Containments.

Cumulative Fatigue Damage. The applicant stated in LRA Section 3.5.2.2.1.6 that fatigue analyses of penetrations, hatches, drywell head, downcomer vents, safety relief valve (SRV) discharge piping, and SRV quenchers are TLAAs as defined in 10 CFR 54.3. Fatigue TLAA are evaluated as documented in LRA Section 4.6.

The staff reviewed LRA Section 3.5.2.2.1.6 against the criteria in SRP-LR Section 3.5.2.2.1.6, which states that if included in the current licensing basis, fatigue analyses of suppression pool steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) for all types of PWR and BWR containments and BWR vent header, vent line bellows, and downcomers are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

SER Section 4.6 documents the staff's review of the applicant's evaluation of this TLAA.

Cracking due to Stress Corrosion Cracking (SCC). The applicant stated in LRA Section 3.5.2.2.1.7 that (1) SCC is not an applicable aging effect primary containment penetration sleeves, vent line headers, and downcomers because they are carbon steel components not susceptible to SCC, and (2) SCC is not an applicable aging effect for dissimilar metal welds in the SSES primary containment penetration sleeves since the welds are not subject to an aggressive chemical environment.

The staff reviewed LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7, which states that cracking due to stress corrosion cracking of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds could occur in all types of PWR and BWR containments. Cracking due to SCC could also occur in stainless steel vent line bellows for BWR containments. The existing program relies on ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J to manage this aging effect. The GALL Report recommends further evaluation of additional appropriate examinations/evaluations implemented to detect these aging effects for stainless steel penetration sleeves, penetration bellows and dissimilar metal welds, and stainless steel vent line bellows.

The staff noted that the penetration sleeves, vent line headers, and downcomers are carbon steel components. The staff acknowledged that stainless steel must be subject to both high temperature (>140°F) and an aggressive chemical environment to be susceptible to SCC. The staff also noted that the dissimilar metal welds in the penetration sleeves located inside and/or outside the primary containment drywell are within the Reactor Building, and are not subject to an aggressive chemical environment.

On the basis of its review, the staff finds that SCC is not a susceptible aging effect for SSES primary containment penetration sleeves, vent line headers, and downcomers because they are carbon steel components, not stainless steel components. The staff also agrees that cracking due to SCC for dissimilar metal welds in the SSES Primary Containment penetration sleeves is not applicable to SSES since the conditions necessary for SCC, both high temperature (>140 °F) and exposure to an aggressive environment, do not simultaneously exist.

Cracking due to Cyclic Loading. The applicant stated in LRA Section 3.5.2.2.1.8 that SSES penetrations do not use expansion bellows, and penetration sleeves are fabricated of carbon steel. The applicant also addressed cracking due to cyclic loading in shells and penetrations, stating that the SSES AMR results conclude that cracking due to cyclic loading for containment components is not an aging effect requiring management. The applicant explained in the LRA that cyclic loading from plant heatups and cooldowns, containment testing, and from system vibration is very low or limited in numbers of cycles. The SSES analyzed fatigue of cyclic loading for steel elements as a TLAA in LRA Section 4.6.

The staff reviewed LRA Section 3.5.2.2.1.8 against the criteria in SRP-LR Section 3.5.2.2.1.8, which states that cracking due to cyclic loading of suppression pool steel and stainless steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) could occur for all types of containments and BWR vent header, vent line bellows and downcomers. SRP-LR Section 3.5.2.2.1.8 also states that the existing program relies on ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J to manage this aging effect. The SSES ISI Program – IWE and Containment Leakage Rate Test Program are existing programs that are consistent with all elements of GALL AMP XI.S1, "ASME Section XI, Subsection IWE", and GALL AMP XI.S4, "10 CFR Part 50, Appendix J", respectively. The staff's reviews of the ISI Program – IWE and Containment Leakage Rate Test Program are documented in SER Section 3.0.3.1.19 and SER Section 3.0.3.1.22, respectively. The GALL Report recommends further evaluation for detection of this aging effect.

The staff reviewed the AMR and its associated AMPs in the LRA. During the on-site review of the associated AMPs, the staff also interviewed applicant's technical personnel. The staff confirmed that SSES operating experience did not identify any events related to cyclic loading induced cracking of containment components, and the number of loading cycles is very low or limited. For steel elements, fatigue of cyclic loading for steel elements has been analyzed as a TLAA. The staff's review of the TLAA is documented in SER Section 4.6.

On the basis of its review, the staff finds that cracking due to cyclic loading is not an applicable aging effect for penetration bellows and penetration sleeves because SSES penetrations do not use expansion bellows, and penetration sleeves are fabricated of carbon steel. The staff also agrees that cracking due to cyclic loading for steel and stainless steel elements of containments and vent header, vent line bellows and downcomers is not a plausible aging effect at SSES because the conditions necessary for cracking, the number of loading cycles, is not sufficient to initiate cracking. Therefore, the staff determines that no further evaluation is required.

Loss of Material (Scaling, Cracking, and Spalling) due to Freeze-Thaw. The staff reviewed LRA Section 3.5.2.2.1.9 against the criteria in SRP-LR Section 3.5.2.2.1.9.

SSES primary containments are located within the reactor buildings. The staff finds that loss of material (scaling, cracking, and spalling) due to freeze-thaw is not an aging effect applicable to containments because loss of material (scaling, cracking, and spalling) due to freeze-thaw is applicable only to concrete containments exposed to weather.

Cracking due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability due to Leaching of Calcium Hydroxide. The applicant stated in LRA Section 3.5.2.2.1.10 that cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide are not aging effects requiring management at SSES because (1) aggregates used in SSES containment concrete structures were selected based on testing per ASTM C-289 "Potential Reactivity of Aggregate" and C-295

"Petrographic Examination", (2) SSES specification for concrete prohibits the use of calcium chloride in the concrete mix design, (3) the SSES Primary Containment concrete is not exposed to flowing water, and (4) resistance to leaching is enhanced by using a dense, well-cured, low permeable concrete in accordance with accepted ACI Standards.

The staff reviewed LRA Section 3.5.2.2.1.10 against the criteria in SRP-LR Section 3.5.2.2.1.10, which states that cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide could occur in concrete elements of concrete and steel containments. SRP-LR Section 3.5.2.2.1.10 also states that the existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. The SSES ISI Program – IWL described in LRA B.2.35 is an existing program that is consistent with all elements of GALL AMP XI.S2, "ASME Section XI, Subsection IWL". The staff's review of the applicant's ISI Program – IWL is documented in SER Section 3.0.3.1.20. SRP-LR Section 3.5.2.2.1.10 further states that the GALL Report recommends further evaluation if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff reviewed the LRA including the AMR and the associated AMP, and the UFSAR. During the on-site review of the associated AMP, the staff also interviewed applicant's technical personnel. The staff confirmed that the containment concrete structures are designed in accordance with ACI 318-71 and constructed in accordance with ACI 301-72, which meets the intent of ACI 201.2R-77 as discussed in SER Section 3.5.2.2.1.1, and the SSES containment concrete aggregates are selected in accordance with ASTM standards, which meets the GALL recommendation of investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50 as described in NUREG-1557. The staff also noted that leaching of calcium hydroxide from reinforced concrete becomes significant only if the concrete is exposed to flowing water; however the SSES containment concrete is not exposed to flowing water.

On the basis of its review, the staff agrees that cracking due to expansion and reaction with aggregate, increase in porosity and permeability due to leaching of calcium hydroxide are not plausible aging effects for concrete elements of containments because (1) the absence of the aging effects is confirmed under the ISI Program – IWL, (2) the material selection in accordance with ASTM standards ensures nonreactive concrete aggregates (3) the design and construction of containment concrete structures in accordance with ACI codes enhances resistance to leaching, and (4) SSES containment concrete is not exposed to flowing water. Therefore, the staff determines that no further evaluation is required.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

Aging of Structures Not Covered by Structures Monitoring Program. The applicant stated in LRA Section 3.5.2.2.2.1 that the Structures Monitoring Program is credited for aging management of these effects/mechanisms for the affected concrete structures and structural components even if the AMR did not identify aging effects requiring management.

The staff reviewed LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1, which states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1-5, 7, 9 structures; (2) increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, 9 structures;

(3) loss of material due to corrosion for Groups 1-5, 7, 8 structures; (4) loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, 7-9 structures; (5) cracking due to expansion and reaction with aggregates for Groups 1-5, 7-9 structures; (6) cracks and distortion due to increased stress levels from settlement for Groups 1-3, 5-9 structures; and (7) reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation for Groups 1-3, 5-9 structures. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the structures monitoring program. In addition, SRP-LR Section 3.5.2.2.2.1 also states that lock up due to wear could occur for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the structures monitoring program or ASME Section XI, Subsection IWF to manage this aging effect. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ISI (IWF) or structures monitoring program.

The staff noted that the applicant's Structures Monitoring Program described in LRA Section B.2.39 is credited for aging management of these effects/mechanisms for the affected concrete structures and structural components even if the AMR did not identify aging effects requiring management. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.17. Additional reviews of specific aging effects/mechanisms are discussed below.

1. Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-5, 7, and 9 Structures

   The applicant stated in the LRA that the aging mechanisms associated with cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not aging effects requiring management for SSES concrete structures components because the below-grade environment for SSES is not aggressive, and concrete is designed in accordance with specification ACI 318-71, and constructed in accordance with ACI 301-72. The applicant also stated that concrete constructed to these criteria has a low-water/cement ratio 0.50 or less, adequate air entrainment between 3% and 6% and provides a good quality dense concrete with a low permeability, which meets the intent of ACI 201.2R-77. The applicant further stated that the below-grade environment at SSES is non-aggressive and has been confirmed by water chemistry analysis results. Sampling results from 2004 and 2005 indicated ground water pH minimum value at 5.9, chloride content maximum value of 26 ppm, and sulfate content maximum value of 96 ppm. Therefore, cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not AERMs for SSES Groups 1-5, 7, and 9 structures.

   Through a review of the LRA, the staff determined that the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1-5, 7, and 9 structures are not plausible aging effects at SSES because of (1) the lack of aggressive groundwater. (2) SSES concrete is designed in accordance with specification ACI 318-71 with a high-cement, low-water/cement ratio, which meets the intent of ACI 201.2R-77 as discussed in SER Section 3.5.2.2.1.1 (3) proper curing, and adequate air content between 3 and 6 percent. The above aging effects for these groups are included within the Structures Monitoring Program by the applicant. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

2. Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack for Groups 1-5, 7, and 9 Structures

The applicant stated in the LRA that the SSES concrete is designed in accordance with ACI 318-71, and constructed in accordance with ACI 301-72. Concrete constructed to these criteria has a low-water/cement ratio 0.50 or less, adequate air entrainment between 3% and 6% and provides a good quality dense concrete with a low permeability, which meets the intent of ACI 201.2R-77. The applicant further stated that the below-grade environment is not aggressive. Therefore, the applicant concluded that the increase in porosity and permeability cracking and loss of material (spalling, scaling) due to aggressive chemical attack are not AERMs for SSES Groups 1-5, 7, and 9 concrete structures.

Through a review of the LRA, the staff determined that the increase in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, and 9 structures are not plausible aging effects at SSES because of the lack of aggressive groundwater and the concrete being constructed for durability in accordance with the recommendations that meet the intent of ACI 201.2R-77 as discussed in SER Section 3.5.2.2.1.1. The above aging effects for these groups are included within the Structures Monitoring Program by the applicant. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

3. Loss of Material Due to Corrosion for Groups 1-5, 7, and 8 Structures

The applicant stated in the LRA that SSES Structures Monitoring program is credited for aging management of loss of material due to corrosion for SSES Group 1-5, 7, and 8 structures.

Through a review of the LRA, the staff determined that the loss of material due to corrosion for Groups 1-5, 7, and 8 structures is an aging effect which will be managed by the applicant's Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

4. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, and 7-9 Structures

The applicant stated in the LRA that the SSES concrete is designed in accordance with ACI 318-71, and constructed in accordance with ACI 301-72. Concrete constructed to these criteria has a low-water/cement ratio 0.50 or less, adequate air entrainment between 3% and 6% and provides a good quality dense concrete with a low permeability, which meets the intent of ACI 201.2R-77 standards that preclude the freeze-thaw aging mechanism. Therefore, the applicant concluded that loss of material (spalling, scaling) and cracking due to freeze-thaw are not AERMs for SSES Groups 1-3, 5, and 7-9 structures.

Through a review of the LRA, the staff determined that the loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, and 7-9 structures are not plausible aging effects at SSES because of concrete being constructed in accordance

with ACI standards. The above aging effects for these groups are included within the Structures Monitoring Program by the applicant. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

5. Cracking Due to Expansion and Reaction with Aggregates for Groups 1-5 and 7-9 Structures

The applicant stated in the LRA that the SSES concrete is designed in accordance with ACI 318-71, and constructed in accordance with ACI 301-72. Concrete constructed to these criteria has a low-water/cement ratio 0.50 or less, adequate air entrainment between 3% and 6% and provides a good quality dense concrete with a low permeability, which meets the intent of ACI 201.2R. The applicant also stated that the SSES specification requires that the potential reactivity of aggregates be acceptable based on testing in accordance with ASTM C-289 "Potential Reactivity of Aggregate" and C-295 "Petrographic Examination" and the SSES specification for concrete prohibits the use of calcium chloride in the concrete mix design. Therefore, the applicant concluded that cracking due to expansion and reaction with aggregates for Groups 1-3, 5, and 7-9 structures is not an AERM.

Through a review of the LRA, the staff determined that the cracking due to expansion and reaction with aggregates for Groups 1-5 and 7-9 structures are not plausible aging effects at SSES because (1) the material selection in accordance with ASTM standards ensures nonreactive concrete aggregates, and (2) the SSES concrete design in accordance with ACI 318-71 and construction in accordance with ACI 301-72 meet the intent of ACI 201.2R-77 as discussed in SER Section 3.5.2.2.1.1. The staff finds that Groups 1-5, 7-9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

6. Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3 and 5-9 Structures

The applicant stated in the LRA that reinforced concrete mat foundations have been provided for all structures at SSES and their foundations rest on competent bedrock except for the ESSW Pumphouse, which is supported by natural soil. The applicant also stated that for the past 20 years, the ESSW Pumphouse total differential settlement is well within the permissible limits for this type of structure and no settlement has manifested itself via cracked walls or cracked foundations. Survey readings were carried out for four years and the ESSW Pumphouse had not experienced any significant settlement. No settlement has been experienced for other SSES in-scope structures. SSES does not employ a de-watering system in any of the site structures for control of settlement. Therefore, the applicant concluded that cracks and distortion due to increased stress levels from settlement are not aging effects requiring management for SSES concrete structure components.

Through a review of the LRA, UFSAR Section 2.5.4 "Stability of Subsurface Materials and Foundations" and UFSAR Section 2.5.5 " Stability of Slops", the staff determined that the cracks and distortion due to increased stress levels from settlement for Groups 1-3 and 5-9 structures are not plausible aging effects at SSES because of the nonexistence of these aging mechanisms. The SSES structures are founded on sound

bedrock except for the ESSW Pumphouse, which is supported by natural soil. The total differential settlement of ESSW Pumphouse is well below the allowable limits as discussed in UFSAR Sections 2.5.4 and 2.5. The staff finds that Groups 1-5, 7- 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

7. Reduction in Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1-3 and 5-9 Structures

   In the LRA, the applicant stated that reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations are not aging effects requiring management. The applicant also stated that for SSES concrete foundations the concrete foundations at SSES are not constructed with porous concrete and are not subject to flowing water. The applicant further stated that SSES does not employ a de-watering system at any of the site structures for control of settlement.

   Through a review of the LRA and UFSAR Appendix 3.8B "Concrete, Concrete Materials, Quallity Control, and Special Construction Techniques", the staff determined that reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures are not plausible aging effects because of the nonexistence of these aging mechanisms. The staff confirmed from UFSAR Appendix 3.8B that there are no porous concrete subfoundations for these structures. Therefore, the staff finds these aging effects are not applicable to SSES.

8. Lockup Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

   In the LRA the applicant stated that Lubrite® plates are not used in SSES in-scope structural components. The applicant also stated that lock-up due to wear is not an aging effect requiring management at SSES. Aging degradations of supports designed with or without sliding connections are managed by the ISI Program – IWF and/or the Structures Monitoring Program.

   Through a review of the LRA, the staff determined that the applicant has credited its Inservice Inspection (ISI – IWF) Program and/or the Structures Monitoring Program to manage aging of Lubrite® and Other Sliding Support Surfaces. The staff finds the applicable AMP(s) acceptable for inspection of Lubrite® and Other Sliding Support Surfaces because the GALL Report recommendation described by the associated tables in GALL Volume 2 "Tabulation of Results" is followed. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1. For those line items that apply to LRA Section 3.5.2.2.2.1, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Aging Management of Inaccessible Areas.

Below-Grade Inaccessible Concrete Areas – Freeze-Thaw. SSES is located in an area in which weathering conditions are considered severe. The applicant stated in LRA Section 3.5.2.2.2.2.1 that loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures are not aging effects requiring management at SSES because (1) SSES structures are designed with proper drainage and slope such that ponding or prolonged exposure to standing water on concrete surfaces is not significant, and (2) the SSES concrete design in accordance with ACI 318-71 and construction in accordance with ACI 301-72, which provided a good quality dense concrete with a low permeability, meet the intent of ACI 201.2R-77.

The staff reviewed LRA Section 3.5.2.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.2.1, which states that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures for plants located in moderate to severe weathering conditions.

The staff reviewed the LRA. The staff confirmed that the SSES Structures Monitoring Program described in LRA Section B.2.39 is credited for aging management of these effects/mechanisms for the affected concrete structures and structural components. The staff noted that the Structures Monitoring Program will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation. The staff found that the SSES concrete air content of 3% to 6%, which follows the GALL recommendation, is documented. The staff determined that the SSES concrete mix design addresses freeze-thaw damage potential by using sufficient air content, which creates a large number of closely spaced, small air bubbles in the hardened concrete. The air bubbles relieve the pressure build-up caused by ice formation by acting as expansion chambers.

On the basis of its review, the staff determines that for SSES, loss of material and cracking due to freeze-thaw are aging effects requiring management for below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures since they are located in an area in which weathering conditions are considered severe. However, the staff finds that the applicant's evaluation acceptable because (1) the applicant's Structures Monitoring Program is credited for aging management of these effects/mechanisms for the affected concrete structures and structural components, which includes examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation, and (2) air content of 3% to 6% at SSES conforms to the recommendation in ACI 201.2R-77 for moderate to severe exposure.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.1. For those line items that apply to LRA Section 3.5.2.2.2.2.1, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Below-Grade Inaccessible Concrete Areas – Expansion and Reaction with Aggregates. The applicant stated in LRA Section 3.5.2.2.2.2. that cracking due to expansion and reaction with aggregate is not an aging effect requiring management at SSES because (1)

the SSES concrete structures are designed in accordance with ACI 318-71 and constructed in accordance with ACI 301-72, (2) aggregates used in SSES concrete structures were selected based on testing per ASTM C-289 "Potential Reactivity of Aggregate" and C-295 "Petrographic Examination", and (3) the applicant's Structures Monitoring Program is credited for aging management of these effects/mechanisms for the affected concrete structures and structural components, and the Structures Monitoring Program includes examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

The staff reviewed LRA Section 3.5.2.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2.2, which states that cracking due to expansion and reaction with aggregates could occur in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures. The GALL Report recommends further evaluation of inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff has reviewed the LRA and UFSAR. The staff confirmed that the SSES concrete structures are designed and constructed in accordance with accepted ACI codes, which meets the intent of ACI 201.2R-77 as discussed in SER Section 3.5.2.2.1.1, and the SSES concrete aggregates are selected in accordance with ASTM standards, which meets the GALL recommendation of investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50 as described in NUREG-1557. The staff further noted that the Structures Monitoring Program will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

On the basis of its review, the staff agrees that cracking due to expansion and reaction with aggregate is not a plausible aging effect in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures because (1) the material selection in accordance with ASTM standards ensures nonreactive concrete aggregates, (2) the SSES concrete design in accordance with ACI 318-71 and construction in accordance with ACI 301-72 meet the intent of ACI 201.2R-77, and (3) the applicant's Structures Monitoring Program is credited for aging management of these effects/mechanisms for the affected concrete structures and structural components, which includes examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation. Therefore, the staff determines that no further evaluation is required.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.2. For those line items that apply to LRA Section 3.5.2.2.2.2.2, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Below-Grade Inaccessible Concrete Areas – Settlement and Erosion. The applicant stated in LRA Section 3.5.2.2.2.2.3 that cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations are not aging effects requiring management for SSES below-grade inaccessible concrete components of Groups 1-3, 5 and 7-9 structures because (1) SSES does not employ a de-watering system in any of the site structures for control of settlement, (2) reinforced concrete mat foundations of all SSES structures, except the ESSW pumphouse, rest on competent bedrock and no settlement has been experienced, (3)

the differential settlement of the ESSW pumphouse is well within the permissible limits and wall or foundation crack due to settlement has not been indentified, and (4) SSES base foundation slabs are not constructed of porous concrete below grade.

The staff reviewed LRA Section 3.5.2.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.2.3, which states that cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. SRP-LR Section 3.5.2.2.2.2.3 also states that the existing program relies on the Structures Monitoring Program to manage these aging effects. The SSES Structures Monitoring Program described in LRA Section B.2.39 is an existing program that is consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program." The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.17. SRP-LR Section 3.5.2.2.2.2.2 further states that the GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's Structures Monitoring Program.

The staff reviewed the LRA including the AMR and its associated AMP. The staff noted that the SSES base foundation slabs are not constructed of porous concrete below grade. The staff also verified that the differential settlement of the ESSW pumphouse is well within the permissible limits during the on-site review of its associated AMP. The staff further noted that the associated AMP Structures Monitoring Program is credited for aging management of these effects for the affected concrete structures and structural components, and will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

On the basis of its review, the staff finds that cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking and differential settlement due to erosion of porous concrete subfoundations are not plausible aging effects in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures because the conditions necessary for aging effects, such as porous concrete material, flowing water environment, and/or soil environment, do not exist. The Structures Monitoring Program is credited for aging management of these effects for the affected concrete structures and structural components. Therefore, the staff finds that no further evaluation is required.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.3. For those line items that apply to LRA Section 3.5.2.2.2.2.3, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21 (a)(3).

Below-Grade Inaccessible Concrete Areas – Aggressive ChemicalAttack and Corrosion of Embedded Steel. The applicant stated in LRA Section 3.5.2.2.2.2.4 that the loss of material and change in material properties due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not aging effects requiring management at SSES because (1) groundwater analyses confirm that the SSES site groundwater is not aggressive, and (2) the design of the SSES concrete in accordance with ACI 318-71 and construction in accordance with ACI 301-72 enhance the resistance to chemical attack through the use of dense concrete with low permeability, and generally prevent corrosion of embedded steel from occurring.

The staff reviewed LRA Section 3.5.2.2.2.2.4 against the criteria in SRP-LR Section 3.5.2.2.2.2.4, which states that increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of plant - specific programs to manage the aging effects for inaccessible areas if the environment is aggressive.

To ensure non-aggressive groundwater chemistries, the GALL Report suggests the periodic groundwater inspection for chlorides, sulfates, and pH. The staff noted that the applicant's groundwater inspection program is performed by the applicant's Structures Monitoring Program described in LRA Section B.2.39. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.17.

The staff reviewed the LRA including the AMR and the associated AMP. During on-site review of the associated AMP, the staff reviewed some related on-site documents. The staff noted the plant-specific operating experience did not reveal any significant degradation. The absence of concrete aging effects in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures is confirmed under the Structures Monitoring Program. The staff confirmed that the below-grade environment at SSES is non-aggressive (Chlorides < 500 ppm, Sulfates <1500 ppm, and pH > 5.5). The staff further validated that the Structures Monitoring Program is credited for management of the aging effects, will include review of site ground water and raw water pH, chlorides, and sulfates during the period of extended operation, and will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

On the basis of its review, the staff finds that the increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not plausible aging effects in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures because (1) the plant-specific operating experience did not reveal any degradation not bounded by industry experience, (2) the concrete being constructed meets the intent of ACI 201.2R as discussed in SER Section 3.5.2.2.1.1 for durability with a high cement, low water/cement ratio, and (3) the inspection frequency of groundwater chemistries under the applicant's Structures Monitoring Program agrees with the recommendation of the GALL Report for groundwater monitoring, and to date, the applicant's inspection results show the groundwater is not aggressive. Therefore, the staff finds that no further evaluation is required.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.4. For those line items that apply to LRA Section 3.5.2.2.2.2.4, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21 (a)(3).

Below-Grade Inaccessible Concrete Areas – Leaching of Calcium Hydroxide. The applicant stated in the LRA Section 3.5.2.2.2.2.5 that cracking increase in porosity and permeability due to leaching of calcium hydroxide is not an aging effect requiring management in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures because (1) the concrete components below grade are not exposed to flowing water, and (2) resistance to leaching is

enhanced by using a dense, well-cured, low permeable concrete in accordance with accepted ACI Standards.

The staff reviewed LRA Section 3.5.2.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.2.5, which states that increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. SRP-LR Section 3.5.2.2.2.2.5 further states the GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The GALL Report states that an aging management program is not necessary for inaccessible areas, even if reinforced concrete is exposed to flowing water, if there is documented evidence that confirms the in-place concrete was constructed in accordance with the recommendations in ACI 201.2R-77.

The staff reviewed the LRA. The staff noted that the concrete structures are designed in accordance with ACI 318-71 and constructed in accordance with ACI 301-72. The staff also noted that leaching of calcium hydroxide from reinforced concrete becomes significant only if the concrete is exposed to flowing water; however, the concrete components below grade are not exposed to flowing water.

On the basis of its review, the staff finds that cracking increase in porosity and permeability due to leaching of calcium hydroxide is not an applicable aging effect in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures because concrete components below grade are not exposed to flowing water, and the design and construction of concrete in accordance with accepted ACI codes meet the intent of ACI 201.2R-77 as discussed in SER Section 3.5.2.2.1.1.

Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.3.

The applicant stated in LRA Section 3.5.2.2.2.3 that SSES in-scope concrete structures and concrete components are maintained below the 150°F threshold for general areas and under 200°F for local areas.

SRP-LR Section 3.5.2.2.2.3 states that reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR Group 1-5 concrete structures. For any concrete elements that exceed specified temperature limits, further evaluations are recommended. SRP-LR Section 3.5.2.2.2.3 also states the GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits, i.e., general area temperature greater than 66°C (150°F) and local area temperature greater than 93°C (200°F).

The staff reviewed the LRA and noted that no portion of the concrete components at SSES exceeds specified temperature limits, which are 150°F for general areas and 200°F for local areas.

On the basis of its review, the staff finds that reduction of strength and modulus of concrete due to elevated temperatures are not applicable aging effects to SSES because the conditions

necessary for the aging effects, elevated temperatures, do not exist. Therefore, the staff finds that no further evaluation is required

Aging Management of Inaccessible Areas for Group 6 Structures. The staff reviewed LRA Section 3.5.2.2.2.4 against the criteria in SRP-LR Section 3.5.2.2.2.4

SRP-LR Section 3.5.2.2.2.4 states that the GALL Report recommends further evaluation for inaccessible areas of certain Group 6 structure/aging effect combinations as identified below, whether or not they are covered by inspections in accordance with the GALL Report, Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC / US Army Corp of Engineers dam inspections and maintenance.

The staff's review and evaluation of aging management of inaccessible areas for Group 6 structures are addressed as follows.

Below-Grade Inaccessible Concrete Areas. The applicant stated in the LRA Section 3.5.2.2.2.4.1 that increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel in below-grade inaccessible concrete areas of Group 6 structures are not aging effects requiring management at SSES because (1) corrosion of structural steel components is addressed by the Structures Monitoring Program. The RG1.127 Water-Control Structures Inspection is credited for aging management of rest of the aging effects/mechanisms, even if the AMR did not identify aging effects requiring management, (2) analyses confirm that the SSES site environment is not aggressive, and (3) the design of the SSES concrete in accordance with ACI 318-71 and construction in accordance with ACI 301-72 enhance the resistance to chemical attack through the use of dense concrete with low permeability, and generally prevent corrosion of embedded steel from occurring.

The staff reviewed LRA Section 3.5.2.2.2.4.1 against the criteria in SRP-LR Section 3.5.2.2.2.4.1, which states that increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas if the environment is aggressive.

The GALL Report recommends that the existing program relies on "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" for accessible areas. The SSES RG 1.127 Water-Control Structures Inspection described in LRA Section B.2.40 is an existing program that is consistent, with enhancements, with GALL AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants." The staff's review of the applicant's RG 1.127 Water-Control Structures Inspection is documented in SER Section 3.0.3.2.18. For inaccessible areas, the GALL Report recommends an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is nonaggressive; and further evaluation of plant-specific programs to manage these aging effects, if the environment is aggressive.

The staff reviewed the LRA, including the AMR and associated AMPs. The staff noted that the concrete structures are designed in accordance with ACI 318-71 and constructed in accordance

with ACI 301-72. The staff also validated from applicant's inspection results that the chemistries in groundwater and raw water at SSES are not aggressive.

On the basis of its review, the staff finds that the increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel in below-grade inaccessible concrete areas of Group 6 structures are not plausible aging effects at SSES because (1) the plant-specific operating experience did not reveal any degradation, (2) the concrete being constructed meets the intent of ACI 201.2R as discussed in SER Section 3.5.2.2.1.1 for durability with a high cement, low water/cement ratio, (3) the applicant's inspections of groundwater and raw water chemistries confirm that the environment is not aggressive, and (4) the Structures Monitoring Program and the RG1.127 Water-Control Structures Inspection are credited for aging management of these aging effects/mechanisms, even if the AMR did not identify aging effects requiring management.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4.1. For those line items that apply to LRA Section 3.5.2.2.2.4.1 the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Below-Grade Inaccessible Concrete Areas – Freeze-Thaw. The applicant stated in the LRA Section 3.5.2.2.2.4.2 that SSES is located in an area in which weathering conditions are considered severe. The loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Group 6 structures are aging effects requiring management at SSES because the concrete located in the ESSW Pumphouse, Spray Pond, and the Cooling Tower Basins may become saturated and, therefore, could be susceptible to freeze-thaw. The applicant further stated in LRA Section 3.5.2.2.2.4.2 that the RG 1.127 Water-Control Structures Inspection is credited to monitor for degradation of the Spray Pond and the ESSW Pumphouse. The Structures Monitoring Program is credited to monitor for degradation of the Cooling Tower Basins.

The staff reviewed LRA Section 3.5.2.2.2.4.2 against the criteria in SRP-LR Section 3.5.2.2.2.4.2, which states that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas for plants located in moderate to severe weathering conditions.

The staff reviewed LRA Section 3.5.2.2.2.4.2. The staff noted that the RG1.127 Water-Control Structures Inspection is credited to monitor for degradation of the Spray Pond and the ESSW Pumphouse. The Structures Monitoring Program is credited to monitor for degradation of the Cooling Tower Basins. The staff's review of the RG1.127 Water-Control Structures Inspection and the Structures Monitoring Program are documented in SER Section 3.0.3.2.18 and 3.0.3.2.17, respectively. The staff verified that the SSES concrete design in accordance with ACI 318-71 and construction in accordance with ACI 301-72, which provided a good quality dense concrete with a low permeability, meet the intent of ACI 201.2R-77 as discussed in SER Section 3.5.2.2.1.1. The staff particularly validated the SSES concrete air content of 3% to 6%, which is consistent with the ACI 201.2R-77 as the GALL recommended.

On the basis of its review, the staff finds that loss of material and cracking due to freeze-thaw are aging effects in below-grade inaccessible concrete areas of Group 6 structures because SSES is located in an area in which weathering conditions are considered severe. Since the design and construction of the SSES concrete is in accordance with the accepted ACI Standards which prevents the freeze-thaw aging mechanism, the staff finds that applicant's inspections in accordance with the RG1.127 Water-Control Structures Inspection, or the Structures Monitoring Program to manage loss of material (spalling, scaling) and cracking due to freeze-thaw in below grade inaccessible concrete areas of Group 6 structures is adequate and no additional plant-specific program is required.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4.2. For those line items that apply to LRA Section 3.5.2.2.2.4.2 the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Below-Grade Inaccessible Reinforced Concrete Areas. The applicant stated in LRA Section 3.5.2.2.2.4.3 that cracking due to expansion and reaction with aggregate and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are not aging effects requiring management in below grade inaccessible reinforced concrete areas of Group 6 structures because (1) aggregates used in SSES concrete structures were selected based on testing per ASTM C-289 "Potential Reactivity of Aggregate" and C-295 "Petrographic Examination", (2) SSES specification for concrete prohibits the use of calcium chloride in the concrete mix design, (3) resistance to leaching is enhanced by using a dense, well-cured, low permeable concrete in accordance with accepted ACI Standards, and (4) the RG 1.127 Water-Control Structures Inspection is credited for aging management of these effects/mechanisms for the affected concrete structures and structural components, even if the AMR did not identify aging effects requiring management.

The staff reviewed LRA Section 3.5.2.2.2.4.3 against the criteria in SRP-LR Section 3.5.2.2.2.4.3, which states that cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below grade inaccessible reinforced concrete areas of Group 6 structures. The GALL Report recommends further evaluation of inaccessible areas if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The GALL Report recommends that the existing program relies on "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" for accessible areas. The SSES RG1.127 Water-Control Structures Inspection described in LRA Section B.2.40 is an existing program that is consistent, with enhancements, with GALL AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants." The staff's review of the applicant's RG1.127 Water-Control Structures Inspection is documented in SER Section 3.0.3.2.18. For inaccessible areas, the GALL Report recommends that aging management is not necessary if the concrete was constructed in accordance with ACI 201.2R.

The staff reviewed the LRA, including the AMR and the associated AMP. The staff noted that the concrete structures were designed in accordance with ACI 318-71 and constructed in accordance with ACI 301-72, which meets the intent of ACI 201.2R-77 as discussed in SER Section 3.5.2.2.1.1. The staff also validated that aggregates were selected in accordance with

ASTM C-289 and C-295 standards, which meets the GALL recommendation of investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50 as described in NUREG-1557. The staff also noted that leaching of calcium hydroxide from reinforced concrete is not significant even if the concrete exposed to flowing water, if the concrete is constructed to ensure that it is dense, well-cured, and has low permeability. Resistance to leaching is enhanced by using a dense, well-cured concrete with low permeability.

On the basis of its review, the staff finds that cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are not plausible aging effects in below-grade inaccessible reinforced concrete areas of Group 6 structures because (1) the material selection in accordance with ASTM standards ensures nonreactive concrete aggregates, (2) the design and construction of SSES concrete structures in accordance with accepted ACI codes meet the intent of ACI 201.2R-77, and (3) the RG 1.127 Water-Control Structures Inspection is credited, and the absence of concrete aging effects is confirmed under the program.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4.3. For those line items that apply to LRA Section 3.5.2.2.2.4.3 the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking due to Stress Corrosion Cracking and Loss of Material due to Pitting and Crevice Corrosion. The applicant stated in LRA Section 3.5.2.2.2.5 that no tanks with stainless steel liners are included in the structural AMRs.

The staff reviewed LRA Section 3.5.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.5, which states that cracking due to stress corrosion cracking and loss of material due to pitting and crevice corrosion could occur for Group 7 and 8 stainless steel tank liners exposed to standing water. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects.

The staff reviewed the LRA. The staff noted that no tanks with stainless steel liners are included in the structural AMRs. Tanks subject to AMR are evaluated with their respective mechanical systems.

On the basis of its review, the staff finds that cracking due to stress corrosion cracking and loss of material due to pitting and crevice corrosion that could occur for Group 7 and 8 stainless steel tank liners exposed to standing water are not applicable since there are no tanks with stainless steel liners included in the structural AMRs. Tanks subject to an AMR are evaluated with their respective mechanical systems.

Aging of Supports Not Covered by Structures Monitoring Program. The applicant stated in LRA Section 3.5.2.2.2.6 that the Structures Monitoring Program is credited for aging management of the following effects/mechanisms: (1) loss of material due to general and pitting corrosion, for Groups B2-B5 supports; (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports.

The staff reviewed LRA Section 3.5.2.2.2.6 against the criteria in SRP-LR Section 3.5.2.2.2.6, which states that the GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) loss of material due to general and pitting corrosion, for Groups B2-B5 supports; (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

The staff reviewed LRA 3.5.2.2.2.6. The staff noted that the component support/aging effect combinations of (1) loss of material due to general and pitting corrosion, for Groups B2-B5 supports; (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports are all covered by the structures monitoring program. Therefore, the staff determined that no further evaluation is required.

Based on the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.6. For those line items that apply to LRA Section 3.5.2.2.2.6 the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cumulative Fatigue Damage due to Cyclic Loading. The applicant stated in LRA Section 3.5.2.2.2.7 that during the process of identifying TLAA in CLB, no fatigue analyses were identified for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3.

The staff reviewed LRA Section 3.5.2.2.2.7 against the criteria in SRP-LR Section 3.5.2.2.2.7, which states that fatigue of component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports is a TLAA as defined in 10 CFR 54.3 only if a CLB fatigue analysis exists. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-LR.

The staff reviewed LRA Section 3.5.2.2.2.7. The staff confirmed that no fatigue analyses were identified as TLAAs because no CLB fatigue analysis exists for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3. Therefore, cumulative fatigue damage for Groups B1.1, B1.2, and B1.3 component supports is not a TLAA as defined in 10 CFR 54.3.

3.5.2.2.3 Quality Assurance for Aging management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicatn's QA program.

3.5.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In the applicant LRA Tables 3.5.2-1 through 3.5.2-10, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-10, the applicant indicated, via notes F through J that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicate that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.5.2.3.1 Aging Management Review Results - Primary Containment – LRA Table 3.5.2-1

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the primary containment component groups.

In LRA Table 3.5.2-1, the applicant identified 38 unique component/material/environment/aging effect/AMP groups for the Primary Containment. Thirty have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For seven groups, the applicant proposed to manage concrete material, below grade and protected from weather environment, aging affect none, by using the Structures Monitoring Program and ISI-IWL Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Because, the applicant has committed under Structures Monitoring Program to perform ground-water sampling to ensure that the ground-water is non-aggressive, as consistent with the GALL Report recommendation. Since the applicant has committed to appropriate aging management

program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one group, the applicant proposed to manage stainless steel material, aging affect none, by using the ISI-IWE and Containment Leak Rate Test Program. The staff's review of the ISI-IWE and Containment Leak Rate Test Program are documented in SER Section 3.0.3.1.19 and 3.0.3.1.22 respectively. This line item references Note I and plant-specific Note 501 and 506, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." And "The process line penetrations are of welded steel construction without expansion bellows, gaskets or sealing compounds. Containment piping and mechanical penetrations do not contain thermal insulation" respectively. The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMPs are appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Primary Containment not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Aging Management Review Results - Reactor Building – LRA Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the reactor building component groups.

In LRA Table 3.5.2-2, the applicant identified 37 unique component/material/environment/aging effect/AMP groups for the Reactor Building. Twenty-seven have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For ten groups, the applicant proposed to manage concrete material, aging affect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Reactor Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.3 Aging Management Review Results – Engineered Safeguards Service Water Pumphouse and Spray Pond – LRA Table 3.5.2-3

The staff reviewed LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the engineered safeguards service water pumphouse and spray pond component groups.

In LRA Table 3.5.2-3, the applicant identified 23 unique component/material/environment/aging effect/AMP groups for the Engineered Safeguards Service Water Pumphouse and Spray Pond. Thirteen have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For nine groups, the applicant proposed to manage concrete material, aging affect none, by using the RG 1.127 Water Control Structures Inspection that is part of the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

For one group, the applicant proposed to manage earthen material, aging affect loss of form, by using the RG 1.127 Water Control Structures Inspection. The staff's review of the RG 1.127 Water Control Structures Inspection is documented in SER Section 3.0.3.2.18. The staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Engineered Safeguards Service Water Pumphouse and Spray Pond not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.4 Aging Management Review Results – Circulating Water Pumphouse and Water Treatment Building – LRA Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the circulating water pumphouse and water treatment building component groups.

In LRA Table 3.5.2-4, the applicant identified 20 unique component/material/environment/aging effect/AMP groups for the Circulating Water Pumphouse and Water Treatment Building. Twelve have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For eight groups, the applicant proposed to manage concrete material, aging affect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.
On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Circulating Water Pumphouse and Water Treatment Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.5 Aging Management Review Results – Control Structure – LRA Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the control structure component groups.

In LRA Table 3.5.2-5, the applicant identified 17 unique component/material/environment/aging effect/AMP groups for the Control Structure. Nine have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For seven groups, the applicant proposed to manage concrete material, aging affect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

For the remaining one group, the applicant proposed to manage arboron laminate panels material, aging affect none, and aging management program none. These line item reference Note J and plant-specific Note 518, which states "The arboron flooring system panels consist of cellulose based laminate impregnated with thermosetting resins. They are used as raised floor and are located in a mild temperature and humidity controlled environment. SSES plant-specific evaluation concluded no aging management is required for arboron flooring panels." The staff reviewed the LRA, license design basis documents, EPRI 1002950 Structural Tools, Revision 1, August 2003, and the GALL Report and found that these materials do not perform or support any license renewal intended functions that satisfy the scoping criteria of 10 CFR 54.4(a). Therefore, aging management for these materials is not required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Control Structure not

evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.6 Aging Management Review Results – Diesel Generator 'A, B, C, and D' Building – LRA Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the Diesel Generator 'A, B, C, and D' building component groups.

In LRA Table 3.5.2-6, the applicant identified 19 unique component/material/environment/aging effect/AMP groups for the Diesel Generator 'A, B, C, and D' Building. Eight have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For eleven groups, the applicant proposed to manage concrete material, aging affect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Diesel Generator 'A, B, C, and D' Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.7 Aging Management Review Results – Diesel Generator 'E' Building – LRA Table 3.5.2-7

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the diesel generator 'E' building component groups.

In LRA Table 3.5.2-7, the applicant identified 13 unique component/material/environment/aging effect/AMP groups for the Diesel Generator 'E' Building. Three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For ten groups, the applicant proposed to manage concrete material, aging affect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's

AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Diesel Generator 'E' Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.8 Aging Management Review Results – Turbine Building – LRA Table 3.5.2-8

The staff reviewed LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the turbine building component groups.

In LRA Table 3.5.2-8, the applicant identified 28 unique component/material/environment/aging effect/AMP groups for the Turbine Building. Seventeen have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For eleven groups, the applicant proposed to manage concrete material, aging affect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Turbine Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.9 Aging Management Review Results – Yard Structures – LRA Table 3.5.2-9

The staff reviewed LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the yard structures component groups.

In LRA Table 3.5.2-9, the applicant identified 51 unique component/material/environment/aging effect/AMP groups for the Yard Structures. Twenty six have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For twenty two groups, the applicant proposed to manage concrete material, aging affect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

For the remaining three groups, the applicant proposed to manage concrete material, aging affect loss of material cracking, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note G and plant-specific Note 521, which states "The GALL does not list exposed to raw water environment for this component type. SSES OE has shown cases of water accumulating in manholes, trenches (SBO cables). Therefore, aging mechanisms pertaining to raw water environments are also applicable within manholes, valve vaults, and instrument pits. The identified AMP is used to manage aging effects for the period of extended operation." The staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Yard Structures not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.10 Aging Management Review Results – Bulk Commodities – LRA Table 3.5.2-10

The staff reviewed LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the bulk commodities component groups.

In LRA Table 3.5.2-10, the applicant identified 153 unique component, material, environment and aging effect AMP groups for the Bulk Commodities. One hundred twenty eight have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For eight groups, the applicant proposed to manage concrete material, aging affect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

For ten groups, the applicant has none for aging management program to manage stainless steel and aluminum materials (Table 3.5.1 item 3.5.1-50), aging affect none, During the review, the staff noted that the GALL Report recommends the Structures Monitoring Program to manage aging effects of loss of material/pitting and crevice corrosion. These SSES items have the same component, material, and environment combination as in the GALL Report. On May 30, 2008, the staff asked the applicant to provide the technical basis for not following the GALL Report recommendation (RAI 3.5-1). In the letter dated July 08, 2008, the applicant stated that line items (3.5.1-50) for stainless steel material exposed to a weather environment are amended to align with the GALL Report recommendations and Structures Monitoring Program or ISI-IWF AMPs. The staff reviewed the applicant responses and found them acceptable because, after amending' LRA Table 1, line item 3.5.1-50 will be aligned with the GALL Report recommendations.

For the remaining seven groups, the applicant has Note J for rubber, elastomer, gypsum board, pryocrete grout, fiberglass, and insulation jacket and has none for aging management program to manage an aging effects for these items. The staff reviewed the LRA, license design basis documents, EPRI 1002950 Structural Tools, Revision 1, August 2003, and the GALL Report and found that these materials do not perform or support any license renewal intended functions that satisfy the scoping criteria of 10 CFR 54.4(a). Therefore, aging management for these materials is not required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Bulk Commodities not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for containments, structures, and component supports within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6 Aging Management of Electrical and Instrumentation and Controls

The following information documents the staff's review of the applicant's AMR results for the electrical and I&C components and component groups of:

- Non-EQ Insulated Cables and Connections
- Metal Enclosed Bus (Non-Segregated)
- High-Voltage Insulators
- Transmission Conductors and Connections

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the electrical and I&C components and component groups. LRA Table 3.6.1, "Summary of Aging Management Programs for Electrical and I&C Components Evaluated in Chapter VI of the GALL Report," is a summary comparison of the

applicant's AMRs with those evaluated in the GALL Report for the electrical and I&C components and component groups.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff reviewed AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant has identified the appropriate GALL Report AMPs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's evaluation are documented in SER Section 3.6.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.6.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.6.2.2.

The staff also reviewed the remaining AMRs that were not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.6.2.3.

Table 3.6-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.6 and addressed in the GALL Report.

Table 3.6-1 Staff Evaluation for Electrical and Instrumentation and Controls in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements (3.6.1-1)	Degradation due to various aging mechanisms	Environmental Qualification of Electric Components	Yes	TLAA Environmental Qualification of Electrical Components (B.3.2)	Further evaluation, (See Section 3.6.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Electrical cables, connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements (3.6.1-2)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements	No	Non-EQ Electrical Cables and Connections Visual Inspection Program (B.2.41)	Consistent with GALL (See Section 3.6.2.1)
Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (3.6.1-3)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables And Connections Used In Instrumentation Circuits Not Subject to 10 CFR 50.49 EQ Requirements	No	Non-EQ Cables and Connections Used in Low-Current Instrumentation Circuits Program (B.2.42)	Consistent with GALL (See Section 3.6.2.1)
Conductor insulation for inaccessible medium voltage (2 kV to 35 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements (3.6.1-4)	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water trees	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements	No	Non-EQ Inaccessible Medium-Voltage Cables Program (B.2.43)	Consistent with GALL (See Section 3.6.2.1)
Connector contacts for electrical connectors exposed to borated water leakage (3.6.1-5)	Corrosion of connector contact surfaces due to intrusion of borated water	Boric Acid Corrosion	No	Not applicable	Not applicable to BWR
Fuse Holders (Not Part of a Larger Assembly): Fuse holders - metallic clamp (3.6.1-6)	Fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation	Fuse Holders	No	Fuse Holders Program (B.2.50)	Not Consistent with GALL (See Section 3.6.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Metal enclosed bus - bus, connections (3.6.1-7)	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus	No	Metal Enclosed Bus Inspection Program (B.2.44)	Consistent with GALL (See Section 3.6.2.1)
Metal enclosed bus - insulation, insulators (3.6.1-8)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Metal Enclosed Bus	No	Metal Enclosed Bus Inspection Program (B.2.44)	Consistent with GALL (See Section 3.6.2.1)
Metal enclosed bus - enclosure assemblies (3.6.1-9)	Loss of material due to general corrosion	Structures Monitoring Program	No	Structures Monitoring Program (B.2.39)	Consistent with GALL (See Section 3.6.2.1)
Metal enclosed bus - enclosure assemblies (3.6.1-10)	Hardening and loss of strength due to elastomers degradation	Structures Monitoring Program	No	Metal Enclosed Bus Inspection Program (B.2.44)	Consistent with GALL (See Section 3.6.2.1.1)
High-voltage insulators (3.6.1-11)	Degradation of insulation quality due to presence of any salt deposits and surface contamination; loss of material caused by mechanical wear due to wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated	Yes	None	Further evaluation (See SER Section 3.6.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Transmission conductors and connections; switchyard bus and connections (3.6.1-12)	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload	A plant-specific aging management program is to be evaluated	Yes	None	Further evaluation (See SER Section 3.6.2.2.3)
Cable Connections - metallic parts (3.6.1-13)	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	No	Non-EQ Electrical Cable Connections Program	Consistent with GALL (See Section 3.6.2.1)
Fuse Holders (Not Part of a Larger Assembly) - insulation material (3.6.1-14)	None	None	No	Not applicable	Consistent with GALL (See Section 3.6.2.1)

The staff's review of the electrical and I&C component groups followed any one of several approaches: (1) as documented in SER Section 3.6.2.1, the staff reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation, (2) as documented in SER Section 3.6.2.2, the staff reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended, or (3) as documented in SER Section 3.6.2.3, the staff reviewed AMR results for components that the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the electrical and I&C components is documented in SER Section 3.0.3.

3.6.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.6.2.1 identifies the materials, environments, aging effects requiring management, and the following programs that manage aging effects for the electrical and I&C components:

- Non-EQ Insulated Cables and Connections Visual Inspection Program
- Non-EQ Cables and Connections Used in Low-Current Instrumentation Circuits Program

- Non-EQ Inaccessible Medium Voltage Cables Program
- Non-EQ Electrical Cable Connections Program
- Metal Enclosed Bus Inspection Program

In LRA Table 3.6.2-1, the applicant summarizes AMRs for the electrical and instrumentation and controls components and claimed that these AMRs are consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which the GALL Report does not recommend further evaluation, the staff's review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff reviewed those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the electrical and I&C components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.6.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

3.6.2.1.1 Hardening and loss of strength due to elastomer degradation

In the discussion section in LRA Table 3.6.2-1, Note 606, the applicant stated that the inspection of the metal-enclosed bus enclosure assembly elastomers will be performed as part of the metal enclosed bus inspection program. The elastomers will be inspected when the covers of various bus enclosure sections are removed.

The staff noted that in the AMR results line that points to Table 3.6.1, Item 3.6.1-10, the applicant included a reference to Note E.

The staff reviewed the AMR results lines referenced to Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends the AMP XI.S6, "Structures Monitoring Program", the applicant has proposed the Metal-Enclosed Bus Inspection Program. As discussed in Section 3.0.3.1, the staff found the Metal-Enclosed Bus Inspection Program acceptable to inspect the metal enclosed bus elastomer degradation.

The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components

will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.6.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the electrical and I&C components and provides information concerning how it will manage the following aging effects:

- Electrical equipment subject to EQ
- Degradation of insulator quality due to salt deposits or surface contamination, loss of material due to mechanical wear
- Loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the GALL Report recommends further evaluation, the staff reviewed the corresponding AMR line items 3.6.1-11 and 3.6.1-12 in LRA Table 3.6.1. The staff also reviewed applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.6.2.2. The staff's evaluation of items which require further evaluation is discussed below.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

LRA Section 3.6.2.2.1 states that EQ is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.4 documents the staff's review of the applicant's evaluation of this TLAA.

3.6.2.2.2 Degradation of Insulator Quality Due to Salt Deposits or Surface Contamination, Loss of Material Due to Mechanical Wear

The staff reviewed LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2. In LRA Section 3.6.2.2.2, the applicant states that there are no aging effects identified that require aging management for the high-voltage insulators subject to AMR for SSES. Due to its inland location, salt spray from the ocean is not of concern at SSES. The applicant also states that the rural location of SSES provides for minimal contamination from industrial effluents. The buildup of surface contamination is gradual and is periodically washed away by rainfall. The high-voltage insulator within the scope of license renewal are connected to rigid components, such that significant movement is not considered as a stressor, and wear is not identified as an aging mechanism.

The staff reviewed LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2 which states that degradation of insulator quality due to salt deposits or surface contamination may occur in high-voltage insulators. The GALL Report recommends further evaluation of plant-specific AMPs for plants at locations of potential salt deposits or surface contamination (e.g., in

the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind on transmission conductors may occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff noted that various airborne material such as dust, salt and industrial effluent can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most areas such contamination is washed away by rain; the glazed insulator surface aids this contamination removal. A large buildup of contamination could enable the conductor voltage to track along the surface more easily and can lead to insulator flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the sea coast where salt spray is prevalent. Since SSES is not located near facilities that discharge soot or near the sea coast, the rate of contamination buildup on the insulators is not significant and is periodically washed away by rainfall. Therefore, the staff found that degradation of insulator due to salt deposit or surface contamination is not an aging effect requiring management for high-voltage insulators.

The staff noted that mechanical wear could be an aging effect for strain and suspension insulators in that they are subject to movement. Movement of the insulators can be caused by wind blowing the supported transmission conductor, causing it to swing from side to side. If this swinging is frequent enough, it could cause wear in the metal contact points of the insulator string and between an insulator and supporting hardware. In LRA Section 3.6.2.2.2, the applicant states that the high-voltage insulators within the scope of license renewal for SSES are connected to rigid components, such that significant movement is not considered as a stressor and wear is not identified as an aging mechanism. However, the applicant did not describe which components are connected to high-voltage insulators for which wear is not an aging mechanism. In a letter dated July 3, 2008, the staff issued RAI 3.6-5 to request the applicant describe components that are connected to high-voltage insulators and explain why wear is not an aging mechanism for these high-voltage insulators. In a letter dated August 5, 2008, the applicant stated that LRA Section 3.6.2.2.2 was revised in response to the staff's RAI 2.5-1 as documented in Reference 3. The amended LRA includes high-voltage insulators in addition to those connected to rigid components. Based on the amended LRA, the components connected to the SSES high-voltage insulators within the scope of license renewal are transmission conductors, transmission towers, dead end structures, switchyard disconnect switches, motor-operated disconnect switches in the transformer yard, and structural supports. The applicant further stated, in essence, that wear is not identified as an aging mechanism for station post-insulators used to support short lengths of switchyard transmission cable and components such as disconnect switches, because there is not movement involved, and consequently no wear. All connections to station post-insulators are solid bolted connections, such that there is no movement. The applicant also stated that a review of the SSES OE did not reveal any failures of high-voltage insulators due to wear, or any significant issues associated with wear.

The staff finds the applicant response acceptable. The staff noted that all connectors to insulators are solid bolted connections and there is no movement involved. The transmission conductors within the scope of license renewal at SSES are in short spans and the surface areas exposed to wind loads are not significant. Furthermore, the applicant has confirmed that it has not identified any loss of material of insulators due to mechanical wear or any significant issues associated with wear. Therefore, the staff determined that loss of material due to wear is not considered an aging effect and will cause a loss of intended functions of the insulators at SSES.

Based on the program identified, the staff concludes that the applicant's programs meet SRP-LR 3.6.2.2.2 criteria. For those line items that apply to LRA Section 3.6.2.2.2, the staff determines that surface contamination and loss of material due to wear is not an applicable aging effect requiring management for high-voltage insulators at SSES and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2.3 Loss of Material Due to Wind-Induced Abrasion and Fatigue, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of Pre-Load

In LRA Section 3.6.2.2.3, the applicant states that there is no switchyard bus within the scope of license renewal. For transmission conductors and connections subject to AMR, there are no aging effects identified that require aging management. The effects of wind do not require aging management as the sections of transmission conductor in the scope of license renewal are short in length, rigid, and connected to rigid components. The applicant also states that loss of conductor strength due to corrosion of the transmission conductor is not identified as an aging effect due to ample design and a minimal corrosion process at the rural location of SSES. Connection resistance is not identified as a stressor based on the use of good bolting practices and review of site OE.

In the LRA, the applicant further states that the most prevalent aging mechanism contributing to loss of conductor strength of aluminum conductor steel reinforced (ACSR) transmission conductors is corrosion. For ACSR conductors, degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rate depend largely on air quality, which involves suspended particles in the air, sulfur dioxide (SO2) concentration, rain, fog, chemistry, and other weather conditions. Corrosion of ACSR conductors is a very slow process that is even slower in rural areas with less air pollution. The applicant also states that SSES is located in a rural area in north-central Pennsylvania where airborne particle concentrations are comparatively low.

The applicant also states that test performed by Ontario Hydroelectric showed a 30% composite loss of conductor strength for an 80 year-old sample of an ACSR conductor (due to corrosion). With respect to the Ontario Hydroelectric study, the National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60% of the ultimate conductor strength and that consideration for ice, wind, and temperature be included in the design. With a 30% loss of conductor strength, there is still margin between the NESC requirements and the actual conductor strength. The applicant concluded that because the SSES transmission conductor design and installation meet the NESC requirements, the Ontario Hydroelectric study is considered to bound the SSES configuration.

In addition, the applicant states that increased connection resistance is not identified as an aging effect requiring management. Bolted connections associated with transmission conductors employ the use of good bolting practices consistent with the recommendations of EPRI 1003471, "Electrical Connector Application Guideline." The applicant also states that bolting hardware is selected to be compatible with the lugs used on the transmission conductors and Belleville washers are used to compensate for temperature changes and to maintain proper tightness. The applicant further states that its review of OE revealed no bolted connection failures associated with transmission conductors at SSES.

The applicant did not identify certain components within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3) for compliance with the SBO rule. In a letter dated July 30, 2007, the staff asked RAI 2.5-1, and the applicant responsed by letter dated August 23, 2007 with justification for why the switchyard circuit breakers were not included in the scope of license renewal. In a letter dated May 7, 2008, the applicant amended the LRA to include switchyard circuit breakers and high-voltage insulators within the scope of license renewal. As a result of bringing high-voltage insulators into the scope, the applicant revised LRA Section 3.6.2.2.3 to address aging effects of high-voltage insulators. The applicant stated that loss of material due to mechanical wear is not an aging effect for certain strain insulators if they are subject to significant movement. Movement of the insulator can be caused by wind blowing the supported transmission conductor, causing it to swing from side to side. If this swing is frequent enough, it could cause wear on the metallic contact points of the insulator string and between an insulator and the supporting hardware. The applicant also stated that although this aging mechanism is possible, industry experience has shown that transmission conductors do not normally swing unless subjected to a substantial wind and they stop swinging shortly after the wind subsides. Wind loading that can result in conductor sway is considered in the transmission system design.

The staff reviewed LRA Section 3.6.2.2.3 against SRP-LR Section 3.6.2.2.3 which states that loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load could occur in transmission conductors and connections, and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The staff noted that transmission conductor vibration would be caused by wind loading. Industry experience has shown that the transmission conductors do not normally swing and that when they do, due to a substantial wind, do not continue to swing for very long once the wind has subsided. Wind loading that can cause a transmission line and insulators to vibrate is considered in the design and installation. The sections of transmission conductor in the scope of license renewal are short spans, the surface area exposed to wind loads are not significant. Based on this information, the staff determined that loss of material of transmission conductors due to vibration is not an aging effect requiring management.

The staff also noted that corrosion of ACRS conductors is a slow acting aging effect that is even slower for rural areas such as SSES, which generally has less suspended particles and carbon dioxide concentration in the air than urban areas. The applicant states that a test performed by Ontario Hydroelectric showed a 30% composite loss of conductor strength for an 80 year-old sample of an ACSR conductor (due to corrosion). However, the applicant did not provide detailed information to substantiate the conclusion that the Ontario Hydroelectric Study is valid for SSES. In a letter dated July 3, 2008, the staff issued RAI 3.6-2 to request the applicant to explain the test performed by Ontario Hydroelectric and provide details as how SSES's transmission conductors installed at SSES were bounded by the Ontario Hydro test and will have adequate margin for 60 years.

In response to the staff's request, in a letter dated August 5, 2008, the applicant stated that the tests for Ontario Hydro were conducted in the field and in the laboratory. A nondestructive corrosion detector was modified for live line measurement of the loss of galvanizing from the steel cores of the ACSR conductors. The field measurements were performed using a motorized overhead line corrosion detector that traveled along the transmission line. Samples

of the conductors tested in the field also were examined in the lab, through tests of fatigue, tensile strength, torsional ductility, and electrical performance. The applicant also stated that the fatigue and tensile strength testing involved the use of a dynamometer and an electromagnetic shaker, with the conductor strung across a suspension assembly. The NESC requires that the maximum tension of installed conductors shall not be more than 60% of the rated breaking strength under NESC design conditions. NESC design conditions (known as NESC Heavy for all of Pennsylvania) include simultaneous consideration of ice, wind, and temperature. The applicant states that its design criteria for 230kV transmission lines are even more demanding than NESC design criteria (1" radial ice versus 1/2" radial ice and a simultaneous 8 psf wind versus 4 psf wind). The applicant further stated that this conductor loading is higher than NESC and, like NESC, must not exceed 60% rated breaking strength. In addition, the applicant stated that conductor loading requirements are reviewed below for the startup transformer #10 230kv Tap and for the 230kV/500kV yard tie, which operates at 230kV. Both of these lines utilize 1590 kcmil Lapwing 45/7 ACSR conductors. The 1590 describes the cross-sectional area of the conductor in kcmils (1 kcmil = 1000 circular mils, and one circular mil = the cross-sectional area of a circle 1 mil in diameter.). The 45/7 means the conductor has 45 outer strands of aluminum conductor around a two-layer core consisting of 7 strands of galvanized steel wire. The ultimate strength (rated breaking strength) of Lapwing transmission conductor is 42,200 lbs. The applicant also stated that based on a design maximum tension of 21,537 lbs for the startup transformer #10 230kV Tap, the margin between the maximum conductor load and the ultimate conductor strength is 20,663 lbs.; therefore, the margin for ultimate strength is 49%. The applicant further stated that Ontario Hydro study showed a 30% loss of composite conductor strength in the typical 70 year-old conductor. In the case of the Lapwing transmission conductors, a 30% loss of ultimate strength would mean that there would still be adequate margin (46%) between the design maximum load of 21,537 pounds and the eventual conductor strength of 33,085 pounds for the startup transformer #10 230kV Tap (1.12 x 42,200 x 0.7). As noted by Ontario Hydro, "new conductors show an average strength of 112% of rated tensile strength." The 230 kV / 500 kV Yard Tie line has a design maximum conductor tension of 16,000 lbs., and thus, an even greater margin. Both transmission lines exceed the design requirements set forth by the NESC. Therefore, the expected margin at 70 years of age is adequate for these installed transmission conductors at SSES. In addition, the applicant stated that transmission conductor samples tested in the Ontario Hydro Test included samples with 45 No. 7 strands and are representative of the installed conductors at SSES, so the conclusions from the Ontario Hydroelectric Test Report for the remaining strength after 70 years of installation are both conservative and valid for SSES. Therefore, the applicant concluded that loss of conductor strength due to corrosion of the transmission conductors is not an aging effect requiring management for the period of extended operation.

The staff's review determined that the maximum tension of transmission conductors for start up transformer #10 could be 65% of the rated breaking strength after losing 30% of conductor breaking strength due to corrosion (21537 lbs./(1.12 x 42200 x 70% lbs). NESC requires that the maximum tension of installed conductors shall not be more than 60% of the rated breaking strength. The ratio between the maximum tension and ultimate conductor strength would not meet the NESC design requirements during the period of extended operation. The staff expressed its concern during a conference with the applicant and requested the applicant to explain why loss of conductor strength due to corrosion is not a significant aging effect when these conductors would not meet the NESC design requirement after aging effect.

In a letter dated November 11, 2008, the applicant stated that using the PPL conservative design criteria, the maximum design tension for the conductors in the Startup Transformer #10 Tap is 21,537 pounds. To put these loadings in perspective, the PPL design is compared to the

NESC "Heavy" requirements. Based on a simulation using an industry standard sag-tension computer program, the design maximum tension of 21,537 pounds under the PPL criteria of 1 inch radial ice simultaneously with an 8 psf wind and 0 degree F temperature corresponds to an NESC "Heavy" design maximum tension of 16,195 pounds. The 16,195 pound maximum tension is 38% of rated breaking strength under initial (newly installed conductor) conditions. Therefore, the NESC criteria are met. The applicant further stated that based on the NESC "Heavy" equivalent design maximum tension of 16,195 pounds for the Startup Transformer #10 230kV Tap conductors, the difference between the design maximum conductor load of 16,195 pounds and the ultimate conductor strength is 26,005 pounds, which produces a margin for ultimate strength of 62% [26,005 / 42,200 = 62%]. In addition, the applicant stated that the Ontario Hydro study showed a 30% loss of composite conductor strength in the typical 70 year-old conductor. In the case of the Lapwing transmission conductors, a 30% loss of ultimate strength equates to an eventual conductor strength of 33,085 pounds for the Startup Transformer #10 230kV Tap (1.12 x 42,200 x 0.7). As noted by Ontario Hydro, "new conductors show an average strength of 112% of rated tensile strength." Based on the NESC "Heavy" equivalent design maximum tension of 16,195 pounds for the Startup Transformer #10 230kV Tap conductors, the difference between the design maximum conductor load of 16,195 pounds and the eventual conductor strength of 33,085 is 16,890 pounds, which produces a margin for ultimate strength of 51% [16,890 / 33,085 = 51%]. The applicant concluded that loss of conductor strength due to corrosion of the transmission conductors is not an aging effect requiring management for the period of extended operation.

The staff finds the applicant's response acceptable. The previously heavy loading of 21537 lbs. was based on the heavy loading of 1 inch radial ice simultaneously with an 8 psf wind on a transmission conductor. The calculated heavy loading of 16890 lbs. was based on NESC heavy loading requirement of a 1/2" radial ice and a simultaneous 4 psf wind. The ratio between the heavy loading and the ultimate conductor strength of a 70 year old transmission conductor (after loosing 30% of conductor strength due to corrosion) is 49% (16890 lbs./1.12 x 42200 lbs. x 0.7). The NESC requires that the maximum tension of installed conductors shall not be more than 60% of the rated breaking strength under NESC design conditions. The ratio of maximum heavy load and the ultimate conductor strength of installed conductors are below the 60% NESC requirements. Furthermore, the length of transmission conductors in-scope of license renewal is short span. These transmission conductors connecting the switchyard to the startup transformer provide restoration of offsite power after a SBO event. The heavy loading of these transmission conductors is much less than the calculated heavy loading of a transmission line. Based on this information, the staff determined that loss of conductor strength due to corrosion of transmission conductor is not a significant aging effect requiring management for the period of extended operation. The staff's concern about loss of conductor strength due to corrosion is resolved.

In LRA Section 3.6.2.2.3, the applicant stated that bolted connections associated with transmission conductors employ the use of good bolting practices consistent with the recommendations of EPRI 1003471, "Electrical Connector Application Guideline." However, the applicant did not explain how its good bolting practices are consistent with EPRI 1003471. In a letter dated July 3, 2008, the staff issued RAI 3.6-3 to request the applicant to describe how the bolted connections associated with transmission conductors at SSES follow EPRI 1003471 recommendations. In their response dated August 5, 2008, the applicant stated that the following bolted connection practices are used at SSES to ensure integrity of transmission conductor bolted connections. These practices are consistent with the design and assembly guidance in EPRI 1003471.

- Washers are used between the connector and bolt heads and nuts to protect the surface of the connector when the bolt is turned.
- Belleville washers are used to keep the load on the connection as the connectors and bolting materials respond to heat up and cool down.
- The use of Belleville washers is predetermined for certain connector and bolting material combinations and specified in the construction specifications.
- Contact surfaces are cleaned, scoured (except plated surfaces) to remove any oxide material coating, wiped with a dry clean cloth, and immediately coated with an oxide inhibiting joint compound.

The applicant also stated that the bolting practices used for SSES transmission conductor connections have been proven by reliable operation of the transmission system and the switchyards associated with SSES.

The staff finds the applicant response acceptable because pre-load of bolted connections is maintained by the use of lock and Belleville washers that absorb vibration and prevent loss of pre-load. Contact surfaces are cleaned and coated with an oxide inhibiting joint compound (a grease-type sealant) to prevent the formation of oxides on the metal surface and to prevent moisture from entering these services, thus reducing changes of corrosion. Based on this information, the staff determines that the design of transmission connections using Bellville washers will eliminate the potential torque relaxation of bolted connections. This design is consistent with the recommendation in EPRI document TR-104213, "Bolted Joint Maintenance & Application Guide."

However, the staff noted that EPRI document TR-104213 identified a special problem with Belleville washers. Hydrogen embrittlement is a recurring problem with Belleville washers and other springs. When springs are electroplated, the plating process forces hydrogen into the metal grain boundaries. If the hydrogen is not removed, the spring may spontaneously fail at any time while in service. In a letter dated July 3, 2008, the staff issued RAI 3.6-3 (b) to request the applicant to explain if electroplated Belleville washers are currently used at SSES. The staff also requested the applicant to describe activities used to confirm the effectiveness of switchyard bolted connections. In response dated August 5, 2008, the applicant stated that the Belleville washers in use with the transmission conductors are stainless steel and are not electroplated. Therefore, they are not subject to the hydrogen embrittlement aging effect. The applicant also stated that switchyard bolted connections are routinely inspected using thermography to confirm effectiveness of the connections. The staff found the applicant's response acceptable because the special problem with hydrogen embrittlement is not a concern at SSES since the Belleville washers in use with the transmission conductors are stainless steel. The concern with hydrogen embrittlement aging effect is not applicable to SSES. Furthermore, the applicant currently performs routine inspection using thermography to confirm the effectiveness of switchyard connections.

The staff noted that increased resistance of connections due to oxidation could occur in transmission conductors and connections, and in switchyard bus and connections. In LRA Section 3.6.2.2.3, the applicant stated that increased connection resistance is not identified as an aging effect requiring management. However, the applicant did not provide any basis for this conclusion. In a letter dated July 3, 2008, the staff issued RAI 3.6-3.c to request the applicant to explain why increased resistance of connections due to oxidation is not identified as an aging effect requiring management. In a letter dated August 5, 2008, the applicant stated that

increased connection resistance of switchyard connections due to oxidation is not identified as an aging effect requiring management because of the use of good bolting practices that include proper cleaning of contact surfaces, application of oxide inhibiting compound, and the use of appropriate hardware to ensure the connection remain tight. These bolting practices minimize the formation of an oxide layer directly at the contact point.

The staff found the applicant response acceptable. The staff noted that proper cleaning of contact surface and using an anti-oxidant compound (grease-type sealant) prior to tightening the connection prevent the formation of oxides on the metal surface and prevent moisture from entering the connection, thus reducing the chances of oxidation. Industry OE has shown that this method of installation provides a corrosion-resistance connection of low electrical resistance. Furthermore, the applicant has stated that connections at the switchyard are periodically evaluated via thermography as a preventive maintenance. On this basis, the staff determined that aging mechanism of increased resistance of connections due to oxidation is not a significant aging effect requiring management at SSES.

Based on the programs identified above, the staff concludes that the applicant's program meet SRP-LR Section 3.6.2.2.3 criteria. For those line items that apply to LRA Section 3.6.2.2.3, the staff determines that loss of material, loss of conductor strength, and increased resistance of connections or loss of preload in transmission conductors and connections, and in switchyard bus and connections, are not applicable to SSES. The applicant has demonstrated that the effect of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program for AMPs.

3.6.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Table 3.6.2-1, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Table 3.6.2-1, the applicant indicated, via notes F through J that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.6.2.3.1 Fuse Holders - Metallic Clamp

In LRA, Table 3.6.1, under Item 3.6.1-06, Fuse Holders (Not Part of a Large Assembly), the applicant states that the aging effects detailed in NUREG-1801 are not applicable for this item at SSES. In LRA, Section 3.6.2.3.1, the applicant states that the fuse holders are located in

metallic electrical boxes (terminal boxes) which have covers that protect the interior of the box from the environment. The applicant further states that by design, these fuses are not removed more than once per year, therefore, fatigue due to frequent manipulation does not apply. GALL NUREG 1801, Rev. 1, Item VI.A-8 identifies corrosion and fatigue as one of aging effect/mechanism for fuse holders (metallic clamp) and recommends fuse holder AMP XI.E5. Condensation inside fuse panels could create a corrosive environment for fuse holders. Manipulation (removing and inserting) of fuse elements during maintenance could weaken the fuse holder clips and could create fatigue aging effects. In a letter dated July 3, 2008, the staff issued RAI 3.6-1 to request the applicant to explain why corrosion of fuse holders inside fuse panels due to condensation is not an aging effect requiring management. The staff also requested the applicant to provide technical justification of how the manipulation of fuse holders for maintenance activities will not create a fatigue aging effect.

In a letter dated August 5, 2008, the applicant responded that corrosion (due to condensation) in the metallic electrical boxes housing for the fuses within the scope of license renewal and subject to AMR is not expected because the boxes are located in a controlled indoor environment and contain no components that experience temperatures less than ambient. The applicant stated that its inspection of a sample of the 20 in-scope metal electric boxes containing the fuse holders subject to AMR showed no corrosion or evidence of water intrusion or collection. The metallic electrical boxes were clean and dry. The applicant also stated that the additional 20 cycles of fuse removal and insertion in fuse holders, where the fuse is removed once per year, is not expected to create a fatigue aging effect on the fuse holder clips. This conclusion is based on engineering judgment when considering the threshold for low cycle fatigue and the material properties of a typical fuse clip. As stated in EPRI, 1003056, "Non-Class 1 Mechanical Implementation Guidelines and Mechanical Tools," Appendix H, Page 1-1, "Low cycle fatigue failure might occur after fewer than 10,000 cycles but only if strains exceed the yield strain." The applicant further stated that this statement suggests that absent of excessive strain, low cycle fatigue would not be expected until after thousands of cycles, which is many more than the number of cycles projected for the fuse clips in the scope of this AMP. The fuse clip material properties determine what constitutes excessive strain, and because the fuse clips are made from a spring material, it is expected that the alloys used to manufacture the clips will have fairly high yield strengths. The applicant also stated that engineering judgment indicates that the strain created during removal and insertion of the fuse is well below the yield strain of the fuse clip material. A fatigue aging effect on the fuse holder clips is not expected due to the additional 20 cycles of manipulation. The lack of excessive strain and the fact that the total number of cycles on the spring clips is very low, as compared to thousands of cycles expected for onset of low cycle fatigue, is the basis for the applicant's judgment.

The staff noted that NUREG 1801, Rev. 1, Item VI.A-8 identifies fatigue as one aging effect/mechanism for fuse holder metallic clamps due to manipulation. In addition, OE as discussed in NUREG-1760, Aging Assessment of Safety-Related Fuses Used in Low- and Medium-Voltage Applications in Nuclear Power Plants, documented OE with fuse holder failures due to fatigue. Removal and inserting of fuse elements could weaken fuse holder clips. These clips are made of copper alloy which have very low conductor strength. NUREG-1760 recommends that field inspections should include examination of fuse holders since these components account for a significant number of fuse failures due to loosening of the holder clips or electrical connections. It also recommends that maintenance procedures should be reviewed to minimize the removal and reinsertion of fuses to de-energize components since this can lead to degradation of the fuse holders. Fuses that must be removed and inserted for maintenance and surveillance should be included in periodic maintenance and inspection programs to monitor and control the effects of these repetitive activities on the fuse and fuse

holder. Furthermore, the GALL Report AMP XI.E5 recommends testing fuse holders so that the component's intended function will be maintained within the CLB for the period of extended operation. The staff disagreed with the applicant that the fatigue aging effect on the fuse holder clips is not expected due to manipulation. Manipulation of fuse holders for maintenance could create a fatigue aging effect on fuse holder clips.

In response to the staff's concern, in a letter dated November 11, 2008, the applicant stated that twenty fuse boxes (containing only fuses and terminal blocks) were identified within the license renewal scope. Sixteen contain power and control fuses in the plant direct current (DC) power systems and four contain 6-amp fuses associated with the control room emergency lighting system. Of these twenty, none contain fuses that are pulled from their metallic clamps more than once per year. The applicant also stated that "an engineering evaluation concluded that" none of these specified fuse holders has a metallic clamp that will exhibit the aging mechanisms/effects of fatigue and/or frequent manipulation listed in NUREG-1801, Item VI.A-8.

However, to ensure the aging effect of increased connection resistance due to fatigue of the fuse holder clamps is not occurring, SSES will implement a fuse holder program consistent with the recommendations of NUREG-1801, Section XI.E5.

The staff finds the applicant response acceptable because for fuse holders that the applicant periodically pulled fuse elements to de-energize circuits for preventive maintenance activities, the applicant will implement a fuse holder program consistent with the GALL Report AMP XI.E5. The staff evaluation of this program is SER Section 3.0.3. In a letter dated November 11, 2008, the applicant amended LRA Sections 3.6.2.1, 3.6.2.3.1, Table 3.6-1, 3.6.2.1, A1.2.51, A.1.4, B.2, and B.2.50 associated with fuse holder and to add fuse holder as a component type requiring aging management. The staff's concern about fatigue aging effect of fuse holders due to manipulation is resolved.

3.6.2.3.2 Tie Wraps

Tie wraps may be taken credit for in seismic analysis and in plant design specifications primary for separation to preclude ampacity degrading. OE has identified issues with tie wraps. Tie wraps were brittle, degraded, or missing and tie wraps failures affected safety functions of other system/components. The LRA does not discuss tie wraps as a commodity type requiring AMRs. In a letter dated July 3, 2008, the staff issued RAI 3.6-4 to request the applicant to explain why tie wraps do not require an AMR. In particular, the staff requested the applicant to address if tie wraps are given credit in the seismic analysis for the current licensing basis and the effects of tie wraps for 10 CFR 54.4 (a)(2) over 10 CFR 54.4 (a)(1), non safety components whose failure could affect safety-functions.

In response to the staff's request, in a letter dated August 5, 2008, the applicant stated that a review of current licensing basis documentation revealed that SSES does not credit tie wraps in the seismic qualification of cable trays. SSES considered the potential effect on safety-related equipment caused by the failure of plastic cable tie-wraps due to age-related degradation and concluded that the failure of tie wraps that could prevent satisfactory accomplishment of the functions of structures, systems and components (SSCs) identified under 10 CFR 54.4(a)(1) is not credible for the following reasons:

- A review of the OE did not reveal any instances of equipment failures due to degradation of electrical cable tie wraps.

- Sensitive components that could be impacted by a loose tie wrap are installed within protective enclosures.
- SSES employs good housekeeping and foreign material exclusion (FME) practices.

The applicant also stated that reviews of SSES and industry OE did not reveal any occurrences of equipment failures caused by tie wraps outside of active components. Therefore, failure of tie wraps resulting in impact to safety functions is considered a hypothetical failure and based on current license renewal guidance does not need to be considered further for license renewal. The applicant further stated that based on a review of CLB documentation, including the UFSAR, Design Basis Documents, cable installation specifications, and design calculations, electric cable ties are not credited for spacing of cables at SSES. Cable ampacity ratings are based on cable tray fill, cable loading depth, cable diameters, and the number of conductors. Cables are assumed to be organized randomly in the tray and spacing between cables is not a consideration. Therefore, cable tie wraps are not credited in the SSES design for cable ampacity ratings.

The staff found the applicant's response acceptable. Because tie wraps are not credited for seismic analysis or design specifications at SSES, failures of tie wraps will not affect safety-related systems or components from perform their intended function. The applicant has reviewed its OE and did not identify any instances of equipment failures due to degradation of electrical cable tie wraps. Sensitive components that could be impacted by a loose tie wrap are installed within protective enclosures at SSES. The applicant employs good housekeeping and foreign material exclusion (FME) practices. Based on this information, the staff determines that the applicant correctly determined that tie wraps are not within the scope of license renewal.

3.6.3 Conclusion

The staff concludes that, the applicant has provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.7 Conclusion for Aging Management Review Results

The staff reviewed the information in LRA Section 3, "Aging Management Review Results," and LRA Appendix B, "Aging Management Programs." On the basis of its review of the AMR results and AMPs, the staff concludes that the applicant has demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable UFSAR supplement program summaries and concludes that the supplement adequately describes the AMPs credited for managing aging, as required by 10 CFR 54.21(d).

With regard to these matters, the staff concludes that there is reasonable assurance that the applicant will continue to conduct the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB, and any changes made to the CLB, in order to comply with 10 CFR 54.21(a)(3), are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses

This section of the safety evaluation report (SER) addresses the identification of time-limited aging analyses (TLAAs). In license renewal application (LRA) Sections 4.2 through 4.7, PPL Susquehanna, LLC (PPL or the applicant) addressed the TLAAs for Susquehanna Steam Electric Station (SSES), Units 1 and 2. SER Sections 4.2 through 4.8 documents the review of the TLAAs conducted by the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff).

TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term. Pursuant to Title 10, Section 54.21(c)(1), of the *Code of Federal Regulations* (10 CFR 54.21(c)(1)), applicants must list TLAAs in compliance with 10 CFR 54.3.

In addition, pursuant to 10 CFR 54.21(c)(2), applicants must list existing plant-specific exemptions granted in accordance with 10 CFR 50.12, based on TLAAs. For any such exemptions, the applicant must evaluate and justify the continuation of the exemptions for the period of extended operation.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated existing analyses and calculations for SSES against the six criteria specified in 10 CFR 54.3. The applicant indicated that it has identified the analyses and calculations that meet the six criteria by searching the current licensing basis (CLB). The CLB includes the updated final safety analysis report (UFSAR), engineering calculations, technical reports, engineering work requests, licensing correspondence, and applicable vendor reports. In LRA Table 4.1-1, "Time-Limited Aging Analyses," the applicant listed the applicable TLAAs:

- reactor vessel (RV) neutron embrittlement
- metal fatigue
- environmental qualification (EQ) of electrical equipment
- containment liner plate, metal containments, and penetrations fatigue analyses
- main steamline (MSL) flow restrictor erosion analyses
- high-energy line break (HELB) cumulative fatigue usage factors
- core plate rim hold-down bolts

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted pursuant to 10 CFR 50.12, based on TLAAs, and evaluated and justified for continuation through the period of extended operation. The LRA states that each active exemption was reviewed to determine whether it was based on a TLAA. The applicant did not identify any exemptions for the CLB that were dependent on and could change because of time-limited assumptions.

4.1.2 Staff Evaluation

In LRA Section 4.1, the applicant listed the TLAAs for SSES. The staff reviewed the information to determine whether the applicant has provided sufficient information pursuant to 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

As defined in 10 CFR 54.3, TLAAs must meet the following six criteria:

(1) involve structures, systems, and components (SSCs) within the scope of license renewal, as described in 10 CFR 54.4(a)

(2) consider the effects of aging

(3) involve time-limited assumptions defined by the current operating term (40 years)

(4) are determined to be relevant by the applicant in making a safety determination

(5) involve conclusions, or provide the basis for conclusions, related to the capability of the system, structure, and component to perform its intended functions, as described in 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

The applicant reviewed the list of common TLAAs in NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated September 2005. The applicant listed TLAAs applicable to SSES in LRA Table 4.1-1.

The staff confirmed that the applicant's LRA includes the TLAAs that are normally applicable to boiling-water reactor (BWR) applications, including:

- TLAAs on neutron irradiation embrittlement: upper shelf energy (USE), adjusted reference temperature, pressure temperature (P-T) limits, RV circumferential weld probability of failure analyses, RV axial weld probability of failure analyses, and RV reflood analyses.
- TLAAs on metal fatigue of American Society of Mechanical Engineers (ASME) Code Class 1 components (RV and Class 1 piping components), metal fatigue of Non-Class 1 components, and environmentally assisted fatigue.
- TLAAs on environmental qualification of electrical equipment.
- TLAAs on metal fatigue of the containment liner and containment penetrations, including ASME MC structures, downcomer vents and safety/relief valve (SRV) discharge piping, and SRV quenchers.

The staff finds the applicant's identification of these TLAAs acceptable because they are consistent with the TLAAs identified in SRP-LR Sections 4.2, 4.3, 4.4, and 4.6 as being applicable to BWR LRAs.

The staff also verified that the LRA included the following additional plant-specific TLAAs:

- MSL Flow Restrictor Erosion Analyses
- HELB Metal Fatigue Analysis
- Core Plate Rim Hold-down Bolt Stress Relaxation Analysis

The staff confirmed that applicant's identification of these additional TLAAs satisfies the recommendation in SRP-LR Section 4.7 that the applicant identify any additional analyses for the facilities that meet the definition of a TLAA, in accordance with the requirements of 10 CFR 54.3. The staff did not identify any omissions of TLAA for this LRA.

The staff noted that the LRA indicates the TLAA on containment prestressed tendons discussed in SRP-LR Section 4.5 is not applicable to the LRA. The staff confirmed that the design of SSES Units 1 and 2 do not include containment structures designed with pre-stressed tendons. Therefore, based on this confirmation, the staff concludes that the applicant has provided a basis for concluding that the TLAA on prestressed containment tendons is not applicable to the LRA because the SSES containment designs do not include these design features.

Based on its review, the staff concludes that the applicant has satisfied the requirements of 10 CFR 54.3 to identify the TLAAs that are applicable to the LRA because the applicant has satisfied the TLAA identification guidance and recommendations in SRP-LR Sections 4.2, 4.3, 4.4, 4.6, and 4.7, and because the applicant has provided an acceptable basis for concluding that the guidance in SRP-LR Section 4.5, on TLAAs for prestressed concrete tendons, is not applicable to the LRA.

Pursuant to 10 CFR 54.21(c)(1), each TLAA for an application must be found acceptable for the period of extended operation, in accordance with one of the following acceptance criteria:

(i) the analysis remains valid for the period of extended operation

(ii) the analysis has been projected to the end of the period of extended operation

(iii) the effects of aging of the intended function will be managed for the period of extended operation

The staff confirmed that the TLAAs identified by the applicant as being applicable to the LRA have been evaluated by the applicant against the provisions and criteria of 10 CFR 54.21(c)(1). The staff evaluates these TLAAs and provides its bases for accepting them, in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii), in the staff evaluations provided in SER Sections 4.2, 4.3, 4.4, 4.6, or 4.7.

In request for additional information (RAI) 4.1.3, the staff requested that the applicant clarify whether the following exemptions granted to PPL in lieu of meeting the fracture toughness requirements of 10 CFR Part 50, Appendix G, and that were granted under the requirements of 10 CFR 50.60(b) and the exemption approval criteria pursuant to 10 CFR 50.12, should be identified as exemptions based on the time-limited assumptions, as required by 10 CFR 54.21(c)(2):

(1) The exemption in Paragraph 2E of Operating License NPF-14 for Unit 1.

(2) The exemption granted in the staff letter of February 7, 2002, from D. S. Collins (NRC) to R. G. Byram (PPL), granting PPL an exemption to use methods of ASME Code Case N-640 in the generation of the P-T limits for Units 1 and 2.

In its response to RAI 4.1.3, dated June 12, 2007, the applicant clarified that the exemption granted in Operating License NPF-14, Paragraph 2E for Unit 1 is based on the methods for calculating the initial Upper Shelf Energy (USE) and reference nil-ductility temperature (RT_{NDT})

values, pursuant to 10 CFR Part 50, Appendix G required USE and P-T limit calculations, and that these values are based on TLAAs. The staff noted that in NUREG-0800, Chapter 3.5.2, NRC Branch Position EMCB 5-2 states that the initial USE and initial RT_{NDT} values used in USE and P-T limit calculations are established from either drop weight or Charpy-V notch tests performed on unirradiated RPV material impact test specimens, and are not dependent upon the influence of these values to an accumulated neutron irradiation time-limited parameter. Thus, based on this assessment, the staff finds that the applicant has provided an acceptable basis for concluding that the exemption mentioned in Operating License NPF-14, Paragraph 2E, for Unit 1, is not based on a TLAA.

The applicant also clarified that the alternative P-T limit calculation methods discussed in ASME Code Case N-640 have been approved by the staff in the latest version of Regulatory Guide (RG) 1.147 and endorsed by reference in 10 CFR 50.55a. Thus, the exemption to use this code case is no longer necessary and will not be needed for the period of extended operation. The staff confirms the staff endorsed ASME Code Case N-640 for use in RG 1.147, Revision 15. Based on this confirmation, the staff concludes that the exemption to use ASME Code Case N-640 is no longer required and need not be identified as an applicable exemption for the LRA based on a TLAA because: (a) the staff has endorsed the code case for use in RG 1.147, Revision 15 and (b) the applicant may use the Code for the 10-year ISI intervals for the period of extended operation. The applicant may use the Code without receiving prior staff approval, if it identifies this code case for use when updating the ASME Code Section XI edition of record, 12 months prior to entering into these 10-year ISI intervals.

Based on its review, as discussed above, the staff finds the applicant's response to RAI 4.1.3-1 acceptable. Therefore, the staff's concern described in RAI 4.1.3-1 is resolved.

Based on the information provided by the applicant as to the process it used to identify these exemptions and its results, the staff concludes, in accordance with 10 CFR 54.21(c)(2), that there are no TLAA-based exemptions that the applicant must justify prior to entering into and continuing through the period of extended operation.

4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1). The staff confirms, as required by 10 CFR 54.21(c)(2), that no exemption to 10 CFR 50.12 had been granted based on a TLAA.

4.2 Reactor Vessel Neutron Embrittlement

"Neutron embrittlement" is the term for changes in mechanical properties of RV materials caused by exposure to fast neutron flux (E>1.0 MeV) within the vicinity of the reactor core, called the beltline region. The most pronounced material change is a reduction in fracture toughness. As fracture toughness decreases with cumulative fast neutron exposure, the material's resistance to cleavage and ductile fracture decreases. Fracture toughness also depends on temperature. The RT_{NDT}, above which the material behaves in a ductile manner and below which the material behaves in a brittle manner, increases as fluence increases and requires higher temperatures for continued ductility. Regulations governing RV integrity are found in 10 CFR Part 50. Specifically, 10 CFR 50.60 requires all light-water reactors to meet the fracture toughness, P-T limits, and material surveillance program requirements for the reactor coolant pressure boundary (RCPB) pursuant to 10 CFR Part 50 Appendices G and H.

The CLB analyses evaluating reduction of fracture toughness of the reactor pressure vessel (RPV) for 40 years are TLAAs. Neutron fluence, USE, adjusted reference temperature, and vessel P-T limits are time-dependent items that must be investigated to evaluate vessel embrittlement (*i.e.*, fracture toughness of vessel materials). The following sections address fluence, USE, adjusted reference temperature, P-T limits, circumferential welds, and axial welds for RPV beltline materials for the period of extended operation.

4.2.1 Neutron Fluence

4.2.1.1 Summary of Technical Information in the Application

LRA Section 4.2.1 summarizes the evaluation of neutron fluence for the period of extended operation. To evaluate the effects of radiation on RPV material embrittlement, analyses determined neutron fluence for extended power uprate conditions and for extended operation out to 54 effective full-power years (EFPY) (*i.e.*, at the end of 60 years operation). Using actual reactor core power histories to date and conservative estimates of future core designs for each unit, extended operation to 60 years will be bounded by 54 EFPY. High energy (>1 MeV) neutron fluence for the RPV beltline region welds and shells was calculated by the Radiation Analysis Modeling Application (RAMA) fluence methodology developed for the Electric Power Research Institute (EPRI) and the Boiling Water Reactor Vessel and Internals Project (BWRVIP). Use of this methodology for evaluations of fluence was in accordance with guidelines presented in Regulatory Guide (RG) 1.190, as recommended in SRP-LR Section 4. The staff has reviewed and approved the RAMA for BWR RPV fluence predictions and concluded that the RAMA methodology applies to SSES. Fluence was calculated at the inner surface (0-T) of the vessel wall, at one-quarter (1/4-T) and three-quarters (3/4-T) of the vessel wall thickness.

NUREG-1801 (The Generic Aging Lessons Learned (GALL) Report) indicates that ferritic materials for RPV beltline shells, welds, and assembly components must be evaluated for neutron irradiation embrittlement, if high-energy neutron fluence is greater than a threshold value of 1.0E+17 n/cm^2 (0-T location) at the end of the license renewal term. RPV shell courses #1 and #2 and axial welds in these shell courses will experience neutron fluence greater than the threshold value prior to the end of 54 EFPYs of operation. The circumferential weld between shell courses #1 and #2 also will be exposed to neutron fluence exceeding the threshold value during the extended lives of the plants. Shell course #3 and its welds will not experience neutron fluence exceeding the threshold value during the extended lives of the plants. The only RPV assembly items other than the shells and welds likely to experience neutron fluence greater than 1.0E+17 n/cm^2, during the period of extended operation, would be instrumentation nozzles N16A and N16B. These nozzles are fabricated from Inconel SB-166, a non-ferritic material which is not a limiting material in the vessel beltline region; therefore, nozzles N16A and N16B are not subject to 10 CFR Part 50, Appendix G evaluation requirements for irradiation effects. Within the beltline region, only shell courses #1 and #2, their axial welds, and the circumferential weld between shell courses # 1 and #2, require evaluation for neutron embrittlement for the period of extended operation.

4.2.1.2 Staff Evaluation

On four BWRVIP reports related to the RAMA fluence methodology, in the SER dated May 13, 2005, the staff approved the use of the RAMA code for BWR RPV fluence predictions and concluded that the RAMA methodology applies to SSES. The applicant provided fluence values based on the RAMA methodology for the SSES RPV beltline materials in LRA

Section 4.2.1. These fluence values were used throughout LRA Section 4.2 for the RPV neutron embrittlement calculations. The staff confirmed that Units 1 and 2 are BWR-4 plants and their fluence values were calculated in accordance with the guidance of RG 1.190, with no bias in the calculations. Therefore, the staff finds the applicant's fluence values acceptable.

4.2.1.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of neutron fluence in LRA Section A.1.3.1. On the basis of its review of the UFSAR supplement, the staff finds the summary description of the applicant's actions to address neutron fluence is adequate.

4.2.1.4 Conclusion

On the basis of its review, the staff concludes that the fluence values for the SSES RPV beltline materials in LRA Section 4.2.1 are acceptable for use for the RPV neutron embrittlement calculations, throughout LRA Section 4.2. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.2.2 Upper Shelf Energy Evaluation

4.2.2.1 Summary of Technical Information in the Application

LRA Section 4.2.2 summarizes the evaluation of USE values for the period of extended operation. Part 50 of 10 CFR, Appendix G requires that USE values for RPV materials include the effects of neutron radiation and that USE for the beltline materials including plates and welds be maintained at no less than 50 ft-lb for the life of the RV. Calculated neutron fluence values considering both the units' extended power uprate and extended operation to 54 EFPY exceed previously-determined neutron fluence values based on materials surveillance program information for SSES Units 1 and 2. Therefore, projected changes in USE values for the period of extended operation are required in accordance with 10 CFR Part 50, Appendix G. The projected USE values at the end of 54 EFPY for the RPV beltline plates and welds for SSES, Units 1 and 2 were determined in accordance with RG 1.99, Revision 2. For plates and welds that do not meet the 50 ft-lb criterion, an equivalent-margins analysis documented in BWRVIP-74-A, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal," was used instead to evaluate the acceptability of the low USE RPV materials. The results of this evaluation demonstrated that all SSES, Units 1 and 2 plates and welds that do not meet the 50 ft-lb criterion are bounded by the BWRVIP-74-A equivalent margins analysis. Therefore, the applicant concluded that the effects of neutron radiation have been evaluated appropriately, and all RPV beltline materials for SSES, Units 1 and 2 have been demonstrated to remain in compliance with Appendix G of 10 CFR Part 50 for the period of extended operation.

4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.2.2 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

According to RG 1.99, Revision 2, the predicted decrease in USE values due to neutron embrittlement during plant operation is dependent upon the amount of copper in the material and the predicted neutron fluence for the material. This RG recommends a minimum of two

credible data points for the use of surveillance data in the embrittlement evaluation. RG Position 1.2 specifies methods for calculating the predicted decrease in USE values for materials that do not have sufficient credible surveillance data. Since each RPV for Units 1 and 2 has only one set of surveillance data, the applicant used RG 1.99, Revision 2, Position 1.2, for calculating the predicted USE decreases for each of the beltline welds and plates for the extended period of operation.

For a conventional USE evaluation, the initial USE value is needed in addition to the USE decrease, to calculate the USE value at 54 EFPY for a RPV material. LRA Tables 4.2-3 and 4.2-5, which the applicant completely revised in its RAI response dated October 18, 2007, provide initial USE values for all Units 1 and 2 RPV beltline materials. This information is consistent with that in the staff's Reactor Vessel Integrity Database (RVID), with two exceptions: (1) the RVID does not record initial USE values for Units 1 and 2 beltline materials having predicted 32 EFPY USE values lower than 50 ft-lb, and (2) the initial USE values for Unit 1 weld Nos. 2 and 5 reported in the revised LRA Table 4.2-3 are 109 ft-lb, while the corresponding values in the RVID are 126 ft-lb and 134 ft-lb, respectively. The staff found that although the RVID values of 126 ft-lb and 134 ft-lb for weld Nos. 2 and 5 are consistent with those in a Surveillance Report Table 7-4, dated May 19, 1994, and Attachment 2 to the applicant's response to GL 92-01, Revision 1, dated June 23, 1994, the Charpy impact energy plots from the May 19, 1994 surveillance report clearly indicated an initial USE value of 109 ft-lb for these welds. Different initial USE values also exist between revised LRA Table 4.2-5 and the RVID for Unit 2 weld Nos. 5 and 7. The staff evaluated the discrepancies and concluded that the applicant's revised LRA Tables 4.2-3 and 4.2-5 represent the most accurate information as to initial USE values for the Units 1 and 2 RPVs. Therefore, the applicant's revised LRA Tables 4.2-3 and 4.2-5 represent the most accurate information as to initial USE values for the Units 1 and 2 RPVs. Based on these initial USE values, the applicant used RG 1.99, Revision 2 to calculate the percent USE decrease and the 54 EFPY USE values at the 1/4-T location for all Units 1 and 2 RPV beltline materials and presented the results in revised LRA Tables 4.2-3 and 4.2-5. The staff performed an independent evaluation and confirmed the applicant's 54 EFPY USE values for all RPV beltline materials. Thus, pursuant to 10 CFR 54.21(c)(1)(ii), the staff finds that the Units 1 and 2 RPV beltline materials which have 54 EFPY USE values at 1/4-T greater than 50 ft-lb (see revised LRA Tables 4.2-3 and 4.2-5) meet the 10 CFR Part 50, Appendix G USE requirement to the end of the period of extended operation.

The BWR Owners Group prepared an equivalent margins analysis in Topical Report BWRVIP-74-A, to demonstrate that lower values of USE will provide margins of safety against fracture equivalent to those required by ASME Code Section XI, Appendix G. The equivalent margins analysis from BWRVIP-74-A utilized the technique originally developed in GE Topical Report NEDO-33205-A, "10 CFR Part 50, Appendix G, Equivalent Margin Analysis for Low Upper Shelf Energy in BWR/2 through BWR/6 Vessels," Revision 1, February 1994. The staff reviewed and accepted BWRVIP-74-A, as documented in the staff's SER dated October 18, 2001. Consequently, a plant without initial USE data or having a projected USE value lower than 50 ft-lb may reference BWRVIP-74-A to confirm that equivalent margins of safety against failure are maintained for its RPV beltline welds or plates by demonstrating that the percent USE decrease in each weld or plate is less than the allowable USE decrease for welds or plates established in BWRVIP-74-A.

For the RPV beltline materials in LRA Tables 4.2-3 and 4.2-5 that do not meet the 50 ft-lb criterion through the end of the period of extended operation, the applicant performed equivalent margins analysis evaluations and summarized the results in revised LRA Tables 4.2-4 and 4.2-6. The staff confirms that the BWRVIP-74-A equivalent margins analysis

was appropriately applied and the percent USE decreases for the RPV materials that did not meet the 50 ft-lb criterion are less than the allowable USE decrease established in BWRVIP-74-A for RPV welds and plates. Therefore, pursuant to 10 CFR 54.21(c)(1)(ii), the staff finds the Units 1 and 2 RPV beltline materials which have 54 EFPY USE values at the 1/4-T location less than 50 ft-lb (see revised LRA Tables 4.2-3 and 4.2-5) also meet the 10 CFR Part 50, Appendix G USE requirement to the end of the period of extended operation.

4.2.2.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of USE in revised LRA Section A.1.3.1.2, LRA amendments, and LRA responses dated November 25, 2008. On the basis of its review of the UFSAR supplement, the staff finds the summary description of the applicant's actions to address USE is adequate.

4.2.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for the Units 1 and 2 RPV beltline materials which have 54 EFPY USE values at the 1/4-T location less than 50 ft-lb (see revised LRA Tables 4.2-3 and 4.2-5) also meet the 10 CFR Part 50, Appendix G USE requirement to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and, therefore, is acceptable.

4.2.3 Adjusted Reference Temperature Analysis

4.2.3.1 Summary of Technical Information in the Application

LRA Section 4.2.3 summarizes the evaluation of adjusted reference temperature for the period of extended operation. In addition to USE, the key parameter which characterizes the fracture toughness of a material is RT_{NDT}, which changes as its exposure to neutron radiation increases. The effects of neutron radiation on RT_{NDT} are reflected in this reference temperature change (ΔRT_{NDT}), and the resulting adjusted reference temperature. Adjusted reference temperature, is calculated by adding ΔRT_{NDT} to RT_{NDT} with appropriate margin for uncertainties. The methodology for calculating adjusted reference temperature for the vessel beltline plates and welds is in RG 1.99, Revision 2. Material properties and initial RT_{NDT} values were from analyses of RV surveillance materials. The applicant reviewed data from the staff RVID and the BWRVIP Integrated Surveillance Program and used the highest limiting material property values in computations of ΔRT_{NDT} and adjusted reference temperature for conservative results.

4.2.3.2 Staff Evaluation

The staff reviewed LRA Section 4.2.3 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

The applicant calculated the adjusted reference temperature values based on the 54 EFPY fluences for the Units 1 and 2 RPV beltline materials. The applicant described the results, which the staff accepts and are discussed in SER Section 4.2.1, in LRA Tables 4.2-1 and 4.2-2.

In reviewing the adjusted reference temperature values and the key parameters for their determination, as described in LRA Tables 4.2-7 and 4.2-8, the staff found that the applicant's

chemistry data and initial RT_{NDT} values are identical to those established in the staff's RVID for the Units 1 and 2 RPV beltline materials. The staff independently reviewed all adjusted reference temperature calculations in LRA Tables 4.2-7 and 4.2-8, based on the approved chemistry and fluence data, and determined that the applicant has appropriately followed the guidance of RG 1.99, Revision 2 in determining the projected 54 EFPY adjusted reference temperature values for the Units 1 and 2 RPV beltline materials. The staff's 54 EFPY adjusted reference temperature value for the Unit 1 limiting material, the lower intermediate shell with heat number C0776-1 is 71.5°F, as opposed to the applicant's 72.4°F. The staff's 54 EFPY adjusted reference temperature value for the Unit 2 limiting material, the lower intermediate shell with heat number C2421-3 is 61.9°F, as opposed to the applicant's 62.4°F. The applicant's adjusted reference temperature values are more conservative than the staff's values. LRA Section 4.2.3 further states, "[i]t may be noted that adjusted reference temperature values are well below the 200°F suggested in Section 3 of Regulatory Guide 1.99 and are, thus, acceptable for the period of extended operation." It should be noted that there are no criteria, pursuant to 10 CFR Part 50, for accepting RPV adjusted reference temperatures. The significance of adjusted reference temperatures is evaluated indirectly in another TLAA, in LRA Section 4.2.4, "Pressure-Temperature (P-T) Limits."

In RAI 4.2.3-1, the staff requested that the applicant revise LRA Section 4.2.4 and its associated UFSAR supplement summary description by removing the quoted statement: "[i]t may be noted that adjusted reference temperature values are well below the 200°F suggested in Section 3 of Regulatory Guide 1.99 and are, thus, acceptable for the period of extended operation."

In its response to RAI 4.2.3-1, dated October 18, 2007, the applicant made the appropriate revision.

Based on its review, the staff finds the applicant's response to RAI 4.2.3-1 acceptable because the applicant has appropriately revised the LRA to remove the quote. Therefore, the staff's concern described in RAI 4.2.3-1 is resolved.

4.2.3.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of adjusted reference temperature in LRA Section A.1.3.1. On the basis of its review of the revised UFSAR supplement, the staff finds that the summary description of the applicant's actions to address adjusted reference temperature is adequate.

4.2.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for adjusted reference temperature, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.2.4 Pressure-Temperature (P-T) Limits

4.2.4.1 Summary of Technical Information in the Application

LRA Section 4.2.4 summarizes the evaluation of P-T limits for the period of extended operation. To assure that adequate margins of safety are maintained for various modes of reactor operation, 10 CFR Part 50, Appendix G specifies material P-T requirements for the service life of the RV. The basis for these fracture toughness requirements is in ASME Code Section XI, Appendix G. The ASME Code requires P-T limits for hydrostatic pressure tests and leak tests, for operation with the core not critical during heatup and cool-down, and for core critical operation. Calculations were performed to develop P-T limit curves for Units 1 and 2 for 54 EFPY, but were not submitted as part of the application. The calculations, which were for the bounding regions of the RV, account for the 54 EFPY fluence projections and include the effects of extended power uprate conditions.

The P-T curves were developed in accordance with 10 CFR Part 50, Appendix G and the methods of ASME Code Section XI, Appendix G, 1998 Edition, including the 2000 Addenda.

4.2.4.2 Staff Evaluation

The staff reviewed LRA Section 4.2.4 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

The current P-T limits were approved by the staff on March 30, 2006. These P-T limits are valid for 35.7 EFPY for Unit 1 (Amendment 232) and 30.2 EFPY for Unit 2 (Amendment 209). LRA Section 4.2.4 states that calculations were performed to develop P-T limits in accordance with 10 CFR Part 50, Appendix G and ASME Code Section XI, Appendix G, 1998 Edition, including the 2000 Addenda, for both Units for the extended period of operation, using the 54 EFPY fluence values discussed in LRA Section 4.2.1. However, since the LRA did not include, for staff review, the revised P-T limits valid for 54 EFPY, the staff determined that it is inappropriate for the applicant to state in LRA Section 4.2.4 that, "[t]he 54 EFPY P-T curves for Units 1 and 2 demonstrate that there is sufficient operating margin for hydrostatic tests, heatup, cooldown, and core critical operation to the end of the period of extended operation."

In RAI 4.2.4-1, the staff requested that the applicant revise LRA Section 4.2.4 and its associated UFSAR supplement summary description, replacing the statement above with a clarification that the applicant will submit P-T limit updates to the staff, in compliance with 10 CFR Part 50, Appendix G. The request will change this section of the LRA to comply with 10 CFR 54.21 (c)(1) (iii) instead of 10 CFR 54.21 (c)(1) (ii).

In its response to RAI 4.2.4-1, dated October 18, 2007, the applicant amended LRA Section 4.2.4 to reflect the change requested by the staff.

Based on its review, the staff finds the applicant's response to RAI 4.2.4-1 acceptable because the applicant has appropriately revised the LRA to clarify that it will submit P-T limit updates to the staff, in compliance with 10 CFR Part 50, Appendix G. Therefore, the staff's concern described in RAI 4.2.4-1 is resolved.

The applicant did not include its 54 EFPY P-T limits in the LRA. The staff does not require that the applicant submit these P-T limit curves as part of the LRA for this TLAA. However, the staff determines that the applicant is required to submit revised P-T limits (not necessarily the

54 EFPY P-T limits) in accordance with 10 CFR Part 50, Appendix G, prior to the expiration of the facility's current P-T limit curves, allowing adequate time for staff review and approval. Therefore, the staff finds that the applicant's plan to manage the P-T limits in accordance with 10 CFR 54.21(c)(1)(iii) is acceptable, because the applicant will implement changes to the P-T limit curves through the license amendment process (i.e., through revision of the plant Technical Specifications) and; thus, meet the requirements of 10 CFR 50.60 and 10 CFR Part 50, Appendix G.

4.2.4.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of P-T limits in LRA Section A.1.3.1.

On the basis of its review of the revised UFSAR supplement, the staff finds the summary description of the applicant's actions to address P-T limits is adequate.

4.2.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for P-T limits, the effects of aging on the intended function will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.2.5 Reactor Vessel Circumferential Weld Examination Relief

4.2.5.1 Summary of Technical Information in the Application

LRA Section 4.2.5 summarizes the evaluation of RV circumferential weld examination relief for the period of extended operation. BWRVIP-74-A reiterates the BWRVIP-05 recommendation that RPV circumferential welds may be exempted from examination. The NRC BWRVIP-74-A SER agreed, but required plants to request relief individually. The relief request should demonstrate that at the expiration of the current license the circumferential welds satisfy the BWRVIP-05 limiting conditional failure probability evaluation. This evaluation of circumferential weld parameters is a TLAA. The applicant requested relief from circumferential vessel shell weld volumetric examinations in November 2000. The relief request was granted in February 2001. The submittal included an analysis showing the RV parameters at 32 EFPY within the bounding parameters for Chicago Bridge & Iron (CB&I) vessels from the BWRVIP-05 SER dated July 28, 1998, and with a lower conditional probability of failure for circumferential welds than that stated in the BWRVIP-05 SER. The RPV circumferential weld parameters at 54 EFPY will remain within the bounding parameters for CB&I vessels at 64 EFPY from the BWRVIP-05 SER and the conditional probability of failure for circumferential welds remains below that stated in the BWRVIP-05 SER. The applicant's process for a relief request for circumferential vessel shell weld volumetric examinations prior to the period of extended operation will be the same as during the original licensing period.

4.2.5.2 Staff Evaluation

The staff reviewed LRA Section 4.2.5 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

The technical basis for relief from the ASME Code, Section XI circumferential weld ISI requirements is discussed in the BWRVIP-05 SER. In the BWRVIP-05 SER, the staff concluded that since the failure frequency for circumferential welds in BWR plants is significantly below the criterion specified in RG 1.154, "Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors," and below the core damage frequency of any BWR plant, the failure frequency for RPV circumferential welds is sufficiently low to justify elimination of ISI. The BWRVIP-05 SER indicated that BWR applicants may request relief from the ISI requirements of 10 CFR 50.55a(g) for volumetric examination of RPV circumferential welds by demonstrating that: (1) at the expiration of the license, the circumferential welds satisfy the limiting conditional failure probability for circumferential welds in the BWRVIP-05 SER, and (2) the applicant has implemented operator training and established procedures that limit the frequency of cold over-pressure events to the frequency specified in the BWRVIP-05 SER. The letter indicated that the requirements for inspection of RPV circumferential welds during an additional 20-year license renewal period require reassessment, on a plant-specific basis, as part of any BWR LRA. In addition, the applicant must request relief from the ISI requirements for volumetric examination of circumferential welds for the extended license term, in accordance with the requirements of 10 CFR 50.55a(g).

BWRVIP-74 Section A.4.5 indicates that the BWRVIP-05 SER conservatively evaluated the BWR RPVs to 64 EFPY, which is 10 EFPY greater than what is realistically expected for the end of the license renewal period. BWRVIP-74 Section A.4.5 also indicates that to obtain relief from the ASME Code specified ISI requirements on RPV circumferential welds, each licensee will submit a plant-specific relief request demonstrating that the two BWRVIP-05 SER conditions are satisfied for the period of extended operation. But, BWRVIP-74 Section A.4.5 provides no guidance about the information that should be included in an LRA. Since meeting the first BWRVIP-74 Section A.4.5 condition for a plant-specific relief request (i.e., the first BWRVIP-05 SER condition for the extended period of operation) requires a TLAA, the staff determined that this TLAA information should be included in the LRA. The staff used the mean RT_{NDT} value to evaluate the failure probability of BWR circumferential welds at 32 and 64 EFPY in the BWRVIP-05 SER. The neutron fluence used in this evaluation was the neutron fluence at the RPV inner diameter clad-weld interface.

Although LRA Section 4.2.5 does not provide a comparison of the applicant's plant-specific information with the generic analysis information in the BWRVIP-05 SER to support its conclusion that the Units 1 and 2 RPV beltline circumferential weld parameters at 54 EFPY remain within the bounding parameters for CB&I RPVs at 64 EFPY from the BWRVIP-05 SER, the essential plant-specific information needed for this comparison is available in LRA Section 4.2.3. As a result, the staff performed a comparison in its evaluation. The staff notes LRA Tables 4.2-7 and 4.2-8 show that the initial RT_{NDT} and ΔRT_{NDT} for the limiting circumferential weld for Unit 2 at 54 EFPY (with heat No. 624263/E204A27A) are -20°F and 30.9°F, resulting in a mean RT_{NDT} (without the margin term) of 10.9°F. The corresponding Unit 1 mean RT_{NDT} is -29.7°F. The mean RT_{NDT} from the BWRVIP-05 SER generic analysis for CB&I RPV circumferential weld at 64 EFPY is 70.6°F. Since the 54 EFPY mean RT_{NDT} value for either Unit 1 or Unit 2 is less than the 64 EFPY value from the BWRVIP-05 SER, the staff concludes that the RPV conditional failure probability for either unit at 54 EFPY is bounded by the staff's generic analysis in the BWRVIP-05 SER. The staff also confirms that the copper and nickel, chemistry factor, and initial RT_{NDT} for the limiting weld for both units are consistent with those in the staff's RVID. Therefore, the staff determines that the applicant's RPV circumferential welds satisfy the limiting conditional failure probability for circumferential welds

at the end of the period of extended operation (the first condition established in the BWRVIP-05 SER).

For the relief request mentioned in LRA Section 4.2.5, the staff reviewed and accepted the applicant's implementation of operator training and establishment of procedures, limiting the frequency of cold over-pressure events to the frequency specified in the BWRVIP-05 SER, for the remaining licensed period of operation described in the 2001 SER. Further, the applicant stated in LRA Section 4.2.5, "PPL will process a relief request for circumferential vessel shell weld volumetric examinations prior to the period of extended operation in the same manner that has been the practice during the original licensing period." With this commitment, the staff determines that continued implementation of operator training and establishment of procedures limiting the frequency of cold over-pressure events will be satisfied during the period of extended operation (the second condition established in the BWRVIP-05 SER). The staff determines that this condition concerns specific plant operation procedures, and is not considered a TLAA.

In the BWRVIP-05 SER, the staff concluded that the applicant need not examine the RPV circumferential shell welds, if the corresponding volumetric examinations of the RPV axial shell welds revealed the presence of an age-related degradation mechanism.

In RAI 4.2.5-1, dated September 5, 2007, the staff requested that the applicant confirm whether previous volumetric examinations of the RPV axial shell welds have shown any indication of cracking or other age-related degradation mechanisms in the welds.

In its response to RAI 4.2.5-1, dated October 18, 2007, the applicant verified that previous examinations of the Susquehanna RPV axial shell welds have not identified any relevant indications or other age-related degradation mechanisms in the welds.

Based on its review, the staff finds the applicant's response to RAI 4.2.5-1 acceptable because the applicant has verified that no relevant indications or other age-related degradation mechanisms in the welds were identified as a result of its previous examinations of the axial welds at Units 1 and 2. Therefore, the staff's concern described in RAI 4.2.5-1 is resolved.

The staff finds the applicant's conclusion for this TLAA acceptable because the staff's evaluation, based on the LRA Sections 4.2.3 and 4.2.5 information, indicates that the 54 EFPY conditional failure probability for the RPV circumferential welds for Units 1 and 2 is bounded by the staff analysis in the BWRVIP-05 SER, and because the applicant will submit a relief request addressing the continued use of procedures and training to limit cold over-pressure events during the period of extended operation, prior to the period of extended operation.

4.2.5.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of RV circumferential weld examination relief in LRA Section A.1.3.1. On the basis of its review of the UFSAR supplement, the staff finds the summary description of the applicant's actions to address RV circumferential weld examination relief is adequate.

4.2.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for RV circumferential weld examination relief, the analyses have

been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.2.6 Reactor Vessel Axial Weld Failure Probability

4.2.6.1 Summary of Technical Information in the Application

LRA Section 4.2.6 summarizes the evaluation of RV axial weld failure probability for the period of extended operation. The SER for BWRVIP-74-A evaluated the failure frequency of BWR RPV axially-oriented welds and determined it to be below 5.0E-06 per reactor year for 40 years of reactor operation. Applicants for license renewal must evaluate axially-oriented RPV welds to show that their failure frequency remains below the 5.0E-06 calculated in the BWRVIP-74 SER. The SER states that an acceptable justification is that the limiting axial beltline weld mean-RT_{NDT} at the end of the period of extended operation is less than the values specified in the SER. The axial weld mean-RT_{NDT} at 54 EFPY is projected to be well below that in the SER, and thus the axial weld failure frequency is well below the acceptable limit of 5.0E-06.

4.2.6.2 Staff Evaluation

The staff reviewed LRA Section 4.2.6 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

In the BWRVIP-05 SER, the staff identified a concern regarding the failure frequency of axial welds in BWR RPVs. In response to this concern, the BWRVIP supplied evaluations of axial weld failure frequency in letters dated December 15, 1998, and November 12, 1999. The staff's BWRVIP-05 supplemental SER on these analyses was issued on March 7, 2000. As discussed in the BWRVIP-05 supplemental SER, the staff performed a generic analysis using the Clinton RPV (a CB&I vessel) and established that a mean axial weld RT_{NDT} of 91°F would result in a RPV failure frequency of 2.73×10^{-6}, per reactor-year of operation. This information was repeated in the BWRVIP-74-A SER.

The staff notes that LRA Section 4.2.6 does not provide a comparison of SSES plant-specific information with the Clinton RPV information stated above to support the applicant's conclusion that the Units 1 and 2 RPV beltline axial weld mean-RT_{NDT} at 54 EFPY is projected to be well below that in the BWRVIP-74-A SER. However, since the applicant provided essential plant-specific information needed for this comparison in LRA Section 4.2.3, the staff performed a comparison in its evaluation. Based on LRA Tables 4.2-7 and 4.2-8, the staff finds the mean-RT_{NDT} for the most limiting axial and circumferential weld for both units at 54 EFPY is 10.9°F, less than the mean-RT_{NDT} of 91°F from the BWRVIP-74-A SER.

The staff determines that this comparison supports its conclusion that the failure frequency for the SSES RPV axial welds will be far less than 5×10^{-6} per reactor-year of operation at the end of the period of extended operation. Therefore, the conclusion in LRA Section 4.2.6 is acceptable.

4.2.6.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of RV axial weld failure probability in LRA Section A.1.3.1. On the basis of its review of the UFSAR

supplement, the staff finds that the summary description of the applicant's actions to address RV axial weld failure probability is adequate.

4.2.6.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for RV axial weld failure probability, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.2.7 Reflood Thermal Shock

4.2.7.1 Summary of Technical Information in the Application

LRA Section 4.2.7 summarizes the evaluation of reflood thermal shock for the period of extended operation. The UFSAR Section 3.13.1 documents a concern of possible brittle fracture of the RV from reflooding following a postulated loss-of-coolant accident (LOCA). This concern is addressed in NEDO-10029, "An Analytical Study on Brittle Fracture of GE-BWR Vessels Subject to the Design Basis Accident", in which a very conservative analysis sets an upper limit on brittle fracture failure for the materials and concludes that catastrophic failure is not possible. The NEDO-10029 analysis assumes a neutron fluence of 1E+18 neutrons per square centimeter (n/cm^2) throughout the vessel with a corresponding shift in the RT_{NDT} of 50°F. For SSES, the predicted maximum fluence at 1/4-T vessel wall thickness at 54 EFPY is 9.48E+17 n/cm^2 for Unit 1 and 9.54E+17 n/cm^2 for Unit 2 with an RT_{NDT} shift of 35.9°F for Unit 1 and 38.4°F for Unit 2. Therefore, as the 54 EFPY values are bounded by the values assumed in the NEDO-10029 analysis, the analysis remains valid for the period of extended operation.

4.2.7.2 Staff Evaluation

The staff reviewed LRA Section 4.2.7 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation.

RPV. In LRA Section 4.2.7, the applicant stated that the SSES RPVs are bounded by the NEDO-10029 analysis, because the RT_{NDT} shifts at 54 EFPY (35.9°F for Unit 1 and 38.4°F for Unit 2) are less than the RT_{NDT} shift of 50°F used in the NEDO-10029 analysis. The staff determined that the applicant's assessment is not complete, because the fracture toughness of the RPV material is determined by the RPV operating temperature and the RT_{NDT} value (i.e., the sum of the initial RT_{NDT} value, the shift, and the margin, of the limiting RPV material) and not by RT_{NDT} shifts, only. Further, the staff determined that the applicant must demonstrate that the driving force based on the plant-specific design-basis accident (DBA) and SSES RPV geometry is also bounded by the generic analysis.

In RAI 4.2.7-1 dated September 5, 2007, the staff requested that the applicant confirm that the current licensing basis relies on the NEDO-10029 methodology and conclusions in addressing the reflood thermal shock issue, and demonstrate that the driving force based on the plant-specific DBA and SSES RPV geometry is also bounded by the generic analysis.

In its response to RAI 4.2.7-1, dated October 18, 2007, the applicant stated that the CLB for Units 1 and 2 credits the analysis documented in NEDO-10029 to address the concern for

brittle fracture of the RPV due to reflood, following a postulated LOCA. For the period of extended operation, however, instead of relying on NEDO-10029, the applicant has revised its position by relying on more recent analysis results from the paper, "Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident," published in the Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, in August 1979. This paper was among the submittals in support of the staff's evaluation of the applicant's structural integrity analysis of the Unit 1 RPV, after an out-of-limit cooldown event occurred on January 12, 1989 (NRC Enforcement Action EA 89-042). The staff reconfirmed the acceptability of the 1989 analysis, since it appropriately: (a) selected the controlling DBA LOCA - the steam line break, (b) used finite element analyses in both the thermal and stress analyses, (c) calculated applied stress intensity factors using an influence coefficient approach based on published finite element solutions, and (d) performed a fracture toughness evaluation based on ASME Code, Section XI.

Based on the 1989 analysis results, the applicant further responded that the peak stress intensity factor at 1/4-T of the RPV wall is about 100 ksi$\sqrt{in}$, which occurs at approximately 300 seconds after initiation of the bounding LOCA event (MSL break). At that instant, the crack tip material temperature is 400°F. On the fracture toughness side, the maximum adjusted reference temperature at the end of the period of extended operation for the Units 1 and 2 RPV beltline materials is 72.4°F (see SER Section 4.2.3.2). This yields a fracture toughness of 200 ksi$\sqrt{in}$ for a crack tip material temperature of 400°F, in accordance with ASME Code Section XI, Appendix G, Figure G-2210-1. Since the driving force (applied stress intensity factor) is much less than the material resistance to fracture (fracture toughness), the staff concludes that brittle fracture of the SSES RPVs due to vessel reflood, following a design basis LOCA during the period of extended operation, is not a concern.

Based on its review, the staff finds the applicant's response to RAI 4.2.7-1 acceptable because the applicant ceased to rely on the NEDO-10029 methodology that caused the staff to issue RAI 4.2.7-1 in addressing the reflood thermal shock issue, and has demonstrated that the driving force based on the plant-specific DBA and SSES RPV geometry is less than the fracture toughness of the SSES RPV materials with a comfortable margin. Therefore, the staff's concern described in RAI 4.2.7-1 is resolved.

The staff determines that the applicant's TLAA for reflood thermal shock of the RPVs meets the regulatory requirements of 10 CFR 54.21(c)(1)(ii) because it was projected to the end of the period of extended operation.

RPV Core Shroud. In LRA 4.3.7, the applicant failed to note that other approved LRA applications for plants such as Monticello, Brunswick, and Browns Ferry treated the reflood thermal shock analysis of the RPV core shroud as a TLAA.

In RAI 4.2.7-2, dated September 5, 2007, the staff requested that the applicant clarify whether the reflood thermal shock analysis of the RPV core shroud for SSES should be a TLAA and; if not, provide a justification.

In its response to RAI 4.2.7-2 dated October 18, 2007, that applicant stated that the reflood thermal shock analysis of RPV core shroud was never performed for either unit and is not part of the CLB for Units 1 and 2.

Based on its review, the staff finds the applicant's response to RAI 4.2.7-2 acceptable because the applicant has verified that the reflood thermal shock analysis of RPV core shroud was never

performed for either SSES unit and is, therefore, not part of the CLB for Units 1 and 2. The staff confirms that, pursuant to 10 CFR 54.3(a)(6), an applicant's calculations and analyses are considered as TLAAs only if they are contained or incorporated by reference in the CLB. Therefore, the staff's concern described in RAI 4.2.7-2 is resolved.

4.2.7.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of reflood thermal shock in LRA Section A.1.3.1. As discussed in SER Section 4.2.7.2, the applicant revised its evaluation significantly. The revised UFSAR Supplement Section A.1.3.1 was submitted as a supplement dated December 17, 2007, as part of the applicant's RAI response. On the basis of its review of the revised UFSAR supplement, the staff finds that the summary description of the applicant's actions to address reflood thermal shock is adequate.

4.2.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for reflood thermal shock, the revised analyses have been projected to the end of the period of extended operation. The staff also concludes that the revised UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.3 Metal Fatigue

A metal component subjected to cyclic loading at loads less than the design load may fail due to fatigue. Metal fatigue of components may have been evaluated based on an assumed number of transients or cycles for the current operating term. The validity of such metal fatigue analysis is reviewed for the period of extended operation. The applicant discussed the fatigue design of SSES components in LRA Section 4.3. The staff reviewed the technical information in LRA Section 4.3 according to the guidance provided in SRP-LR Section 4.3.

The staff review identified several areas where additional information was required to complete the review of the applicant's metal fatigue TLAAs in LRA Section 4.3. Therefore, the staff issued RAIs to the applicant. The following discussion describes the staff's RAIs and the corresponding applicant responses.

4.3.1 Reactor Pressure Vessel Fatigue Analyses

4.3.1.1 Summary of Technical Information in the Application

LRA Section 4.3.1 describes the SSES evaluation of TLAAs for the RPV assembly within the scope of license renewal. The applicant discussed the design basis for the RPV assembly and indicated that some 60-year projections of the transients (for the assembly) may exceed the number of cycles used for the design. Table 4.3-1 of the LRA contains the list of reactor design transients and 60-year cycle projections. In addition, Table 4.3-2 of the LRA contains the list of fatigue usage for limiting RCPB locations. These locations include the limiting RPV assembly locations. The applicant stated that metal fatigue of the RPV assembly components is managed by the SSES Fatigue Monitoring Program.

4.3.1.2 Staff Evaluation

In LRA Section 4.3.1, the applicant indicated that the SSES RPV was designed in accordance with the Class 1 requirements of ASME Code Section III. The specific design criterion for fatigue analysis of the ASME Code Class 1 components involves calculating the cumulative usage factor (CUF). The fatigue damage in the component caused by each thermal or pressure transient depends on the magnitude of the stresses caused by the transient. The CUF sums the fatigue damage resulting from each transient. ASME Code Section III requires that the CUF be less than 1.0. The staff reviewed the reactor design transients used in the fatigue analysis of the RPV assembly components.

LRA Table 4.3-1 shows the design transients for the RPV assembly, including the design cycles and 60-year projected cycles. LRA Table 4.3-2 shows the design CUF values and 60-year projected CUF values for the limiting RPV assembly locations. The applicant indicates that the CUFs were calculated based on the transients and cycles shown in LRA Table 4.3-1.

Based on the information in the LRA, the SSES Fatigue Monitoring Program (FMP) relies on transient cycle monitoring to evaluate the fatigue usage described in the license renewal application. The staff notes that to rely on this approach, it is essential that all thermal and pressure activities are bounded by the design specifications and cycles of all significant thermal events are captured and logged. To ensure effectiveness and validity of the fatigue monitoring program, in letter dated April 27, 2009, the staff issued RAI 4.3.1-1, requesting the applicant to:

(a) Confirm that all monitored transient events were bounded by the design specifications.

(b) Specify the time (years) over which actual transient monitoring and cycle tracking activities took place. If there have been periods in which transient data are not recorded since the plant startup, for any type of transient, specify the affected time frame. For the time periods for which transients were not monitored, provide justification to demonstrate that the estimated cycles for this unmonitored period are conservative.

By letter dated May 26, 2009, the applicant responded to RAI 4.3.1-1 Part (a) by describing the transient monitoring procedures in detail and concluded that all monitored transient events are bounded by the design specifications and are conservatively factored into the fatigue usage calculations for the ASME Class 1 reactor coolant pressure boundary components within the FMP. For RAI 4.3.1-1 Part (b), the applicant response indicates that cycle tracking activities have covered the entire operating history of SSES Units 1 and 2.

Based on its review, the staff found the applicants response to RAI 4.3.1-1 acceptable because the applicant provided the information requested in detail and has demonstrated conservatism of the SSES transient monitoring program.

LRA Table 4.3-1 shows that the 60-year projected cycles for a majority of transients are lower than the respective design cycles, approximately by a factor between 2 and 3 for both units. For startup and shutdown transients, the 60-year projected cycles are higher than the design cycles, by approximately 30%. LRA Table 4.3-2 shows that for some of the limiting RCPB locations, the 60-year projected CUF values are much lower than the 40-year design CUF values, up to a factor of 10 and even greater. It appears that the CUF results and the number of transients are out of proportion for certain locations. With this concern, in letter dated April 27, 2009, the staff issued RAI 4.3.1-2, requesting the applicant to justify the large reductions in projected 60-year CUF values seen for some locations, with relatively minor reduction in cycle projections, in spite of some transients having projected cycles higher than the design cycles.

By letter dated May 26, 2009, the applicant provided its response to RAI 4.3.1-2 in detail. The applicant states that for the vessel support skirt, the design CUF values of 0.913 for Unit 1 and 0.888 for Unit 2, were calculated based on a design adequacy evaluation performed to account for new seismic, hydrodynamic, and annulus pressurization loads that were postulated following the original plant design and construction. The applicant also states that when developing the FMP, the design adequacy evaluation for the support skirt was reviewed, and it was determined that a significant portion of the design CUF value was due to these new loads that result from emergency and faulted plant conditions. The applicant further states that since these severe conditions are not anticipated to occur, the 60-year CUF projection, based on the 60-year cycle projections, is significantly lower than the design CUF.

The applicant states that for the core spray nozzle forging, and the recirculation inlet nozzle, the design CUF value of 0.815, were calculated based on the design fatigue analysis for the feedwater nozzle. The applicant also states that bounding these nozzles with the feedwater nozzle analysis is conservative because the feedwater nozzle is a similar design and experiences a higher number of more severe transients than either of the bounded nozzles. The applicant further states that the design fatigue analysis for the feedwater nozzle was overly conservative, because it had assumed cycle counts that are several times higher than the 60-year cycle projections. The applicant concluded that the large reduction in the 60-year CUF projection for these two locations is due to the application of the CBF (cycle-based fatigue monitoring) methodology, combined with an overly conservative original design analysis.

For the FW Nozzle (N4) and the CRD Penetration locations, the applicant asserted that the 60-year CUF values for these two locations were calculated using stress-based fatigue monitoring (SBF) methodology in FatiguePro, and thus the fatigue usage is not totally dependent on the number of cycles.

The staff evaluated the applicant response to RAI 4.3.1-2, as summarized below:

For the case of the vessel support skirt, the staff now realized that the design fatigue analysis included loads from emergency and faulted plant conditions in the calculation, whereas in the 60-year CUF projection, the emergency and faulted loads were removed. In addition, significantly fewer cycles are projected than were used for the design analysis for most of the transients. Per the ASME guidance, emergency and faulted loading conditions do not need to be included in the fatigue usage evaluation. With these changes in loads and cycles a significant reduction in the 60-year CUF projection is expected. Based on this consideration, the staff found the significant drop in CUF projection reasonable.

For the case of the core spray nozzle forging and the recirculation inlet nozzle, the staff now realized that the design fatigue CUFs were in fact taken from the results calculated for the feedwater nozzle. The staff found the bounding approximation for these two nozzles acceptable because it is a conservative approach. But in evaluating 60-year CUF, the applicant used the CBF (cycle-based fatigue monitoring) methodology, along with the 60-year projected cycles applicable to these nozzles. Therefore, the 60-year CUF value shows a more significant drop than the reduction in the number of cycles suggested. This net effect is compounded by the fact that the design CUF for these two nozzles should have been lower than the values taken from the feedwater nozzle results (the bounding approach). Based on this consideration, the staff found the significant drop in the CUF projection reasonable.

For the case of the FW Nozzle (N4) and the CRD Penetration locations where reduction in 60-year projected CUFs are the greatest among the locations listed in LRA Table 4.3-2, the 60-year CUF values as shown in LRA Table 4.3-2 are subject to change because they were produced by the stress-based fatigue monitoring methodology in FatiguePro, nonconforming software -- as documented in RIS 2008-30, titled "Fatigue Analysis of Nuclear Power Plant Components," dated December 16, 2008. As a result, concern regarding the highly significant drop in CUF is resolved. Reevaluations for these two locations, or confirmatory evaluations that demonstrate acceptable results, and for any other cases which utilize the SBF monitoring, are necessary. This effort is described in License Renewal Commitment No. 60.

Based on the discussions presented herein, the staff found the applicant response to RAI 4.3.1-2 acceptable, and the concern as described in the RAI is resolved.

In RAI 4.3-1, dated June 12, 2008, the staff identified the following concerns regarding the transients listed in LRA Table 4.3-1:

(a) LRA Table 4.3-1 provides the number of design cycles as well as 60-year cycle projections. It was not clear from the table how the 60-year cycle projections were calculated. Therefore, the staff requested that the applicant provide the cycles accrued to date and explain how the 60-year projections values were calculated.

(b) The design transients for the RPV assembly are listed in UFSAR Table 3.9-1. The staff reviewed UFSAR Table 3.9-1, and found a discrepancy between the UFSAR Table and LRA Table 4.3.1. Therefore, the staff requested that the applicant explain the difference in the number of design cycles for loss of feedwater heaters and pre-op blowdown between the UFSAR and LRA tables.

(c) The applicant grouped certain transients together, and it was not clear to the staff the basis for grouping these transients together and having a single cycle projection for 60 years. Therefore, the staff requested that the applicant explain why the turbine generator trip transient and other scram transients were grouped and projected together for 60 years. The staff also requested that the applicant explain how scram transient conditions bound all scrams that may be experienced by the plant.

(d) Further, the staff requested that the applicant provide the basis for grouping loss of feedwater heaters and partial feedwater heater bypass as a single transient and include the effect on feedwater nozzle CUF analysis.

In its response to RAI 4.3-1a, dated August 1, 2008, the applicant provided the current cycle counts for Units 1 and 2. The applicant stated that the average number of cycles per year for the past ten-year period was used to estimate the number of additional cycles expected to occur by the end of the period of extended operation. The staff finds the applicant's projections provide a reasonable estimate of the number of transient cycles expected to occur by the end of the period of extended operation. The staff notes that the SSES Fatigue Monitoring Program will monitor the number of actual transients to ensure that they do not exceed the projected 60-year cycles during the period of extended operation.

In its response to RAI 4.3-1b, dated August 1, 2008, the applicant stated that UFSAR Table 3.9-1 lists the total number of cycles for the loss of feedwater heater events as 80. The applicant also stated that 10 of the loss of feedwater heater transients considered in the RPV

fatigue analysis involved a turbine trip with 100 percent steam bypass. The applicant further stated that the SSES bypass system is only capable of 25 percent steam bypass; therefore, these 10 transients were not included in LRA Table 4.3-1. On June 25, 2009, through a teleconference, SSES technical personnel provided additional information to supplement what was presented in the August 1, 2008, response to RAI 4.3-1b. In the teleconference, the applicant stated that SSES FMP will monitor the loss of feedwater heater events with a turbine trip with 25 percent steam bypass flow, and the loss of feedwater heater events with partial feedwater heater bypass as well. The applicant also stated that during the extended operation period SSES will use stress-based fatigue (SBF) monitoring methodology pursuant to Regulatory Issue Summary (RIS) 2008-30 and the actual thermal conditions will be used for the fatigue evaluation. On the basis of its review, the staff found the applicant's explanation reasonable because the applicant will actually count cycles and determine the fatigue usage for the monitored locations.

The applicant stated that UFSAR Table 3.9-1 lists 10 pre-op blowdown events. Further, the applicant stated that the SSES RPVs did not experience any of these events in the pre-operational phase, and that the event is not applicable following the initial startup. Therefore, the event was not included in LRA Table 4.3-1. The staff finds the applicant's explanation acceptable since there will be no pre-op blowdown events for the SSES FMP to monitor during the period of extended operation.

In its response to RAI 4.3-1c, dated August 1, 2008, the applicant stated that UFSAR Table 4.3-1 separates reactor scrams into two categories; namely, 40 cycles of turbine trips and 140 cycles of other scrams. However, LRA Table 4.3-1 lists 180 cycles of reactor scram events. The applicant also stated that the SSES FMP evaluates all reactor scrams using the most limiting transient. The staff finds the applicant's explanation acceptable since the SSES FMP will track the reactor scrams in a conservative manner by assuming the most conservative transient for each scram event.

In its response to RAI 4.3-1d, dated August 1, 2008, the applicant stated that the response to RAI 4.3-1b explains why only Partial Feedwater Heater Bypass events are counted by the SSES Fatigue Monitoring Program. The applicant's response to RAI 4.3-1b is discussed above and accepted. As for the second part of RAI 4.3-1d, the applicant responded that combining the two transients indicated in the present RAI question has no effect on the feedwater nozzle CUF analysis because the feedwater nozzle was evaluated by the stress-based fatigue (SBF) methodology in FatiguePro, wherein fatigue usage were calculated based on the monitored actual plant conditions instead of the design transients. The staff found that the second part of RAI 4.3-1d no longer constitutes a concern because the feedwater nozzle must be reevaluated, as discussed under the staff evaluation of applicant response to RAI 4.3.1-2. On the basis of its review, the staff finds that the concern indicated in RAI 4.3-1d is resolved.

Based on its review, the staff finds the applicant's response to RAI 4.3-1(a-d), dated August 1, 2008, acceptable because the applicant has (a) provided the cycles accrued to date and explained how the 60-year projections values were calculated; (b) adequately explained the difference in the number of design cycles for loss of feedwater heaters and pre-op blowdown between the UFSAR and LRA tables; (c) satisfactorily explained how scram transient conditions bound all scrams that may be experienced by the plant; and (d) provided a reasonable basis for grouping loss of feedwater heaters and partial feedwater heater bypass as a single transient and included the effect on feedwater nozzle CUF analysis. Therefore, the staff's concern described in RAI 4.3-1 is resolved.

In RAI 4.3-2, dated June 12, 2008, the staff requested that the applicant provide a complete list of design transients used to calculate the 60-year CUF projections for the limiting RCPB locations, and describe, in detail, how they are monitored.

In its response to RAI 4.3-2, dated August 1, 2008, the applicant stated that it had provided a complete list of transients in its response to RAI B.3.1-1. The applicant also stated that its FMP automatically monitors a number of the design transients using plant-specific data. The applicant went on to state that a number of design transients cannot be automatically counted by the FMP and must be manually counted, based on the review of the plant data and operating logs, and then entered into the Fatigue Monitoring Program.

Based on its review, the staff finds the applicant's response to RAI 4.3-2 acceptable because the applicant has provided a complete list of design transients used to calculate the 60-year CUF projections for the limiting RCPB locations, and adequately described how they are monitored. The staff determines that the applicant's method of tracking the design transients is reasonable and acceptable.

The applicant noted that some transients may exceed the number used for the design of the RPV components and stated that the limiting components of the RPV will be monitored by the SSES Fatigue Monitoring Program. The applicant committed (Commitment No. 43) to implementing one or more of to the following actions to address locations where the CUFs approach the allowable limit during the period of extended operation:

- Further refinement of the fatigue analyses to lower the CUFs to less than the allowable
- Repair of the affected components
- Replacement of the affected components
- Management by an inspection program that has been reviewed and approved by the staff (e.g., periodic non-destructive examination (NDE) of the affected locations at the intervals determined by a method acceptable to the staff)

As indicated by the applicant, the use of an inspection program to manage fatigue will require prior staff review and approval. The SSES FMP will require that the applicant monitor the fatigue usage of the limiting RPV components and to take corrective actions if the CUF of these components is projected to exceed the allowable value of 1.0, during the period of extended operation. The staff finds that the applicant's FMP provides an acceptable program to manage the fatigue usage of the RPV components during the period of extended operation.

4.3.1.3 UFSAR Supplement

The applicant provided the UFSAR supplement summary description of its TLAA evaluation of the SSES RPV assembly in LRA Section A.1.3.2.1. On the basis of its review of the UFSAR supplement, the staff finds that the applicant has provided an adequate summary description of its actions to address the fatigue evaluation of the RPV assembly.

4.3.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended function(s) of the RPV assembly will be adequately managed during the period of extended operation. The staff

also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.3.2 Reactor Vessel Internals Fatigue Analyses

4.3.2.1 Summary of Technical Information in the Application

LRA Section 4.3.2 describes the SSES evaluation of TLAAs for RPV internals within the scope of license renewal. The RPV internals are described in terms of two assemblies: core support structures and reactor internals. These two assemblies were designed in accordance with ASME Section III, Subsection NG, and were demonstrated to be within allowable limits for 40 years. The applicant performed additional structural evaluations to address operation under extended power uprate conditions and determined that the CUF for all RPV internals remain within the allowable limits for 60 years. Table 4.3-1 of the LRA contains the list of reactor design transients and 60-year cycle projections. In addition, the applicant manages reactor vessel internals by the SSES BWR Vessel Internals Program. The SSES BWR Vessel Internals Program manages the RPV internals through inspections.

4.3.2.2 Staff Evaluation

In LRA Section 4.3.2 the applicant stated that its evaluation demonstrating that the fatigue usage factors for all RPV internals remain within the ASME Code Section III, Subsection NG limits, for the extended period of operation, included the effects of operation under extended power uprate conditions.

In RAI 4.3-8, dated October 22, 2008, the staff requested that the applicant explain how the number of reactor design transient cycles for 60 years of plant operation was determined for the analysis of the RPV internals.

In its response to RAI 4.3-8, dated December 12, 2008, the applicant stated that the number of reactor transient design cycles for 40 years of plant operation was multiplied by 1.5 to obtain the number of cycles for 60 years of plant operation.

Based on its review, the staff finds the applicant's response to RAI 4.3-8 acceptable because the applicant has provided a sufficient explanation for how it determined the number of reactor design transient cycles for 60 years of plant operation for the analysis of the RPV internals. The staff notes that the number of projected reactor transient cycles used in the evaluation of the RPV internals is greater than the 60-year cycle projections provided in LRA Table 4.3-1. Therefore, the staff's concern described in RAI 4.3-8 is resolved.

The staff finds the applicant's evaluation, which includes the effects of the extended power uprate, acceptable and notes that the applicant also monitors the design transients using its Fatigue Monitoring Program. The staff concludes that the FMP provides additional assurance that the fatigue usage of the RPV internals will remain within acceptable limits, for the period of extended operation.

In addition, the staff also reviewed the LRA Section B.2.9, "BWR Vessel Internals Program" using the guidance provided in GALL Aging Management Program (AMP) XI.M9. During the review, the staff noted that the BWR Vessel Internals Program only inspects the top guides for the first 12 years of the period of extended operation. The staff noted that the top guide is

subject to irradiation-assisted stress-corrosion cracking (IASCC), and that neutron fluence increases with plant operation.

In RAI 4.3-4, dated June 12, 2008, the staff requested that the applicant clarify how the aging effect of IASCC will be managed for the remainder for the period of extended operation.

In its response to RAI 4.3-4, dated August 1, 2008, the applicant stated that management of IASCC has been incorporated into SSES BWR Vessel Internals Program. The staff is satisfied with this response to RAI 4.3-4 which addresses how the IASCC will be managed during the period of extended operation for the top guide. The staff evaluation of the SSES BWR Vessel Internals Program is provided in SER Section 3.0.3.2.4.

4.3.2.3 UFSAR Supplement

The applicant provided the UFSAR supplement summary description of its TLAA evaluation of RPV internals in LRA Section A.1.3.2.2. On the basis of its review of the UFSAR supplement, the staff finds the applicant has provided an adequate summary description of its actions to address the fatigue evaluation of the RPV internals.

4.3.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the fatigue TLAA for the RPV internals have been projected to the end of the period of extended operation. In addition, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function of the reactor vessel internals will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.3.3 Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping

4.3.3.1 Summary of Technical Information in the Application

LRA Section 4.3.3 describes the applicant's evaluation of the effects of the reactor coolant environment on the fatigue life of components. The applicant evaluated locations identified in NUREG/CR-6260 that are applicable to SSES. These components included: reactor vessel shell and lower head, reactor vessel feedwater nozzle, reactor recirculation piping (including inlet and outlet nozzles), core spray line reactor vessel nozzle and associated Class 1 piping, RHR return line Class 1 piping, and feedwater line Class 1 piping. Of the 11 locations on these components, 7 have environmentally adjusted CUFs greater than 1.0. The applicant indicated that these locations would be managed by the SSES Fatigue Monitoring Program.

4.3.3.2 Staff Evaluation

The FMP at SSES tracks transients and cycles of reactor coolant system components that have explicit design transient cycles, to assure that these components remain within their design basis. Generic Safety Issue (GSI)-166, "Adequacy of the Fatigue Life of Metal Components," raised concerns as to whether the fatigue curves used in the design of the reactor coolant system components were too conservative. Once GSI-166 was resolved for the initial 40 year design life of operating components, the staff opened GSI-190, "Fatigue Evaluation of Metal

Components for 60 year Plant Life," to address license renewal. The staff closed GSI-190 in December, 1999, concluding:

> The results of the probabilistic analyses, along with the sensitivity studies performed, the iterations with industry (NEI and EPRI), and the different approaches available to the licensees to manage the effects of aging, lead to the conclusion that no generic regulatory action is required, and that GSI-190 is closed. This conclusion is based primarily on the negligible calculated increases in core damage frequency in going from 40 to 60 year lives. However, the calculations supporting resolution of this issue, which included consideration of environmental effects, and the nature of age-related degradation indicate the potential for an increase in the frequency of pipe leaks as plants continue to operate. Thus, the staff concludes that, consistent with existing requirements in 10 CFR 54.21, licensees should address the effects of coolant environment on component fatigue life as aging management programs are formulated in support of license renewal.

The staff reviewed the applicant's environmental fatigue CUFs in LRA Table 4.3-3. The staff noted that the applicant's RPV (Shell at Shroud Support) CUF, including the environmental effects, is projected to exceed 1.0 for 60-year operation. Based on its review of the BWR evaluations in NUREG/CR-6260 and other LRA applications, the staff notes that the RPV shell typically has a CUF (including environmental effects) of less than the allowable value.

In RAI 4.3-3, dated June 12, 2008, the staff requested that the applicant list the transients and corresponding usage factors, and provide the environmental factors used in its evaluation.

In its response to RAI 4.3-3, dated August 1, 2008, the applicant stated that the transients used for the evaluation were listed in its response to RAI B3.1-1. The staff confirmed that the applicant's response to RAI B3.1-1 listed all transients monitored by the SSES Fatigue Monitoring Program. The applicant's calculation indicated that the environmental usage factor has considered the percentage of operating life with hydrogen water chemistry (HWC) and the percentage of operating life with normal water chemistry (NWC). The staff notes that the application of HWC would significantly reduce the environmental effect on fatigue of carbon and low alloy steel components.

In RAI 4.3-10, dated October 22, 2008, the staff requested that the applicant provide a list of transients at the RPV shell shroud support for both units, that are the most significant contributors to the CUFs listed in LRA Table 4.3-2. The staff also requested that the applicant provide a discussion of any conservative assumptions that may have been used in the analyses.

In its response to RAI 4.3-10, dated December 12, 2008, the applicant stated that the shroud support was analyzed for four design transients; natural circulation startup, pre-op blowdown, shutdown, and loss of alternating current power.

The applicant stated that the analysis of these four transients yielded the most severe thermal stresses for the shroud support. The applicant assumed that all transient cycles occurred at the maximum thermal stress, when determining the number of allowable cycles from the fatigue design curves.

This procedure produces a very conservative estimate of the CUF, which explains the relatively high environmental CUF reported for the RPV shell at the shroud support location. The staff notes that the CUF can be significantly reduced by a detailed analysis which considers the actual thermal stress associated with each individual load pair, as discussed in NUREG/CR-6260 Section 4.3.

Based on its review, the staff finds the applicant's response to RAI 4.3-10 acceptable because the applicant has provided a list of transients at the RPV shell shroud support that are the most significant contributors to the CUFs and has adequately explained the assumptions used in its CUF analysis. Therefore, the staff's concern described in RAI 4.3-10 is resolved.

The staff also noted that the environmental usage factors at several other locations in LRA Table 4.3-3 were significantly different from those listed in NURE/CR-6260. The staff determined that SSES is a BWR 4, which is comparable to the older BWR evaluated in NUREG/CR-6260.

In RAI 4.3-9, dated October 22, 2008, the staff requested that the applicant provide a summary of the environmental fatigue life correction factor (F_{en}) calculation for each component analyzed, including values of oxygen level, temperature and strain rate used in the F_{en} calculations. The staff also requested that the applicant provide the basis for the oxygen level, temperature and strain rate values used in the F_{en} calculations.

In its response to RAI 4.3-9, dated December 12, 2008, the applicant stated that the F_{en} multipliers were calculated assuming HWC conditions for 68% for Unit 1 and 70% for Unit 2 of the plant operating life at 60 years. The evaluation of the BWR in NUREG/CR-6260 assumed normal water chemistry (NWC) for the entire plant life. The staff noted that the applicant's response indicated that the dissolved oxygen (DO) level in the feedwater line was low for both NWC and HWC conditions at both units and that the applicant used a F_{en} of 1.74 for the carbon steel components and a F_{en} of 2.45 for the low-alloy steel components of the feedwater nozzle.

The applicant's response also indicated that bounding fluid temperature and strain rates were used to develop the remaining F_{en} multipliers. The NWC DO level for the core spray and recirculation low alloy nozzles was relatively high. This accounted for the relatively high F_{en} multiplier of approximately 13 for both units, even though DO level was low for the HWC conditions which exist for the majority of the plant life. The staff finds the F_{en} values used in the evaluation of the core spray and recirculation nozzles reasonable for the DO levels reported by the applicant.

The applicant also used a F_{en} of approximately 13 for the evaluation of the stainless steel components of the recirculation loop piping for both units. The applicant assumed bounding values for the fluid temperature and strain rate in the calculation of the F_{en} values, using the NUREG/CR-5704 equation for stainless steel components. The staff finds the F_{en} value used for these stainless steel components acceptable, based on the DO levels in the recirculation reported for NWC and HWC.

The staff notes that applying a F_{en} value of 1.74 to carbon steel components and 2.45 to low-alloy steel components, as mentioned above, involves an assumption that the DO level is no greater than 50 ppb during the entire operating time. This can be readily verified by reviewing the applicable equations in NUREG/CR-6583. While the applicant has provided historic sample DO data in the attachment to the response to RAI 4.3-9, the necessity of getting additional information was prompted because that attachment only covers the time period from 1994 to

2007. The DO data for the times prior to 1994, about a 10 year period since the plants' startup, was not provided. Without evidence to show that 50 ppb DO level has been maintained the entire time, bounding environmental conditions would have to be used to calculate F_{en} for the affected periods. With this concern, on April 27, 2009, a follow-up RAI (RAI 4.3-9R) was issued, requesting the applicant to provide additional information significant to the environmental fatigue evaluations, as described below:

(a) Provide dissolved oxygen (DO) data for the SSES at full power for the three summer months of each of the following years: 1985, 1988 and 1991, for both Units 1 and 2.

(b) Describe the methodology of F_{en} calculation which SSES used to deal with the situations where DO content in the feedwater system, over certain periods, has been consistently greater than 50 ppb.

(c) Describe how water samples were taken, including the sampling locations, and justify that the DO data in the feedwater system shown in PLA-6464 are applicable to all NUREG/CR-6260 components for F_{en} calculations.

In its response to RAI 4.3-9R(a), dated May 26, 2009, the applicant provided the DO data for the time periods specified. For Unit 2, 1986 instead of 1985 data were provided because the applicant indicated that Unit 2 had no three-month period of continuous operation in 1985. The applicant also indicated that for Unit 2 the data period was extended beyond three months to show the return to normal oxygen levels following the repair of a leaking condensate pump suction line drain valve, which resulted in the higher than normal feedwater system oxygen levels from July to mid-November 1988.

The staff found the applicant response to part (a) of this RAI acceptable because it provided the information requested. Combining the data provided in the attachment to the response to RAI 4.3-9 and the attachment to the response to RAI 4.3-9R results in more than 20 years of coverage on the DO levels experienced by SSES Units 1 and 2 RV and RCS components, covering nearly the entire plant operating history.

Reviewing the dataset, the staff confirmed that for the reactor water, during the NWC period (prior to 2000), the DO level was maintained in the range between 220 ppb to 320 ppb with a norm of about 270 ppb. During the HWC period (2000 and forward), the reactor water DO level was maintained below 2 ppb. This observation is true for both Unit 1 and Unit 2. For the feedwater, the DO level in Unit 1 was maintained within 50 ppb for the entire plant operating history with occasional insignificant overshooting. The feedwater DO level in Unit 2 was similarly maintained except for a period from July 1988 through mid-November 1988, during which the feedwater DO level stayed relatively high, at about 100 ppb. It is fair to say this is approximately a 6-month time frame, slightly augmented for conservatism. The applicant attributes this elevated DO level to condensate pump suction line drain valve leaking, as described above. The staff found the applicant's reasoning acceptable because the DO of feedwater had returned to below 50 ppb level after the valve was repaired.

In its response to RAI 4.3-9R(b), dated May 26, 2009, the applicant stated that NUREG/CR-6583 and NUREG/CR-5704 do not discuss how to address variable DO levels during operation. The applicant indicates that it had followed the industry guidance provided in EPRI Final Report 1012017 (MRP-47 Revision 1) to evaluate F_{en} based on a simple time-averaged DO level. The staff deemed this approach non-conservative because the material will respond to the current environmental conditions not the average conditions over the operating history. The time-averaged conditions, especially over a lengthy period, will eliminate contributions from short-

lived but severe conditions. Therefore, more involved averaging method will be required to weigh the effects for each period. Nevertheless, for the SSES case, a simple time-averaged method is deemed adequate because the database shows that the period in which the feedwater DO level has exceeded 50 ppb is estimated to be less than 6 months. This represents approximately only 1/120 (i.e., 0.83%) of the intended plant life of 60 years so the impact will be negligible. Based on this consideration, the staff found the applicant's handling of the F_{en} calculations for the feedwater nozzle, feedwater nozzle safe end, and feedwater piping locations reasonable.

In its response to RAI 4.3-9R(c), dated May 26, 2009, the applicant provided the following statements:

> The DO levels in the SSES Units 1 and 2 feedwater systems are normally determined by in-line DO monitors, which continuously sample the feedwater flowing to the Reactor Building Sample Station via the sample line. The feedwater sample line ties into the main feedwater header pipe inside the reactor building. Therefore, the feedwater being sampled is representative of the feedwater flowing to the reactor vessel.
>
> The DO levels in the SSES Units 1 and 2 reactor water are also normally determined by in-line DO monitors, which continuously sample the reactor water flowing to the Reactor Building Sample Station via the sample line. The reactor water sample line ties into the reactor water cleanup line upstream of the filter demineralized inlet. The reactor water cleanup system draws water from the reactor vessel bottom head drain and from each of the recirculation pump suction lines. Therefore, the reactor water being sampled is representative of a mixture of the water in the reactor bottom head and of the water in the reactor annulus region.

The staff found the applicant's response acceptable because it provided the information requested, including presentation of the water sampling methods used and demonstration of applicability of the data to all of the NUREG/CR-6260 locations considered. The applicant presented two parts of DO sampling routines to address the chemical conditions in the feedwater system and in the reactor recirculation water system to support the DO dataset attached to the responses to RAI 4.3-9 and RAI 4.3-9R.

Based on the discussion and evaluation of the responses to all three parts of RAI 4.3-9R, the staff's concern of the F_{en} calculations for the carbon steel and low-alloy steel components is resolved. The F_{en} values used for the 60-year CUF calculations are shown in the applicant's response to RAI 4.3-9, transmitted to NRC Document Control Desk on December 12, 2008, designated as SSES LRA Supplement PLA-6464, where details of the F_{en} calculations for the Recirculation System is also shown.

The applicant used a F_{en} of 1.49 for the evaluation of the Inconel (nickel-chromium-iron alloy) core spray nozzle safe ends. The evaluation demonstrated acceptable fatigue usage for the safe ends at both units. The license renewal guidance provided in NUREG/CR-5704 addresses austenitic stainless steels and does not contain a specific equation that addresses Inconel material. The F_{en} value used by the applicant was based on the equation reported in NUREG/CR-6335, "Fatigue Strain-Life Behavior of Carbon and Low-Alloy Steels, Austenitic Stainless Steels, and Alloy 600 in LWR Environments," August 1995. This F_{en} value is less conservative than the calculated value using the latest equation provided in NUREG/CR-6909,

"Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials," February 2007. The staff notes that NUREG/CR-6909 is not listed in the staff license renewal guidance documents. However, NUREG/CR-6909 does allow for the use of an average temperature in conjunction with an integrated rate approach to determine F_{en}, which is not as conservative as the procedure used by the applicant. Implementation of the NUREG/CR-6909 procedure would probably result in a higher F_{en} value than was used by the applicant for the core spray nozzle safe ends. However, the evaluation performed by the applicant demonstrates that the core spray nozzle (forging) bounds the core spray nozzle safe end on both units. The staff concludes that use of the NUREG/CR-6909 procedure would not result in environmental fatigue usages that are larger in the core spray safe ends than the environmental fatigue usages listed by the applicant for the core spray nozzles. Therefore, the staff finds that the core spray nozzles are the bounding components for the evaluation. The staff further finds that demonstration of an acceptable environmental fatigue usage of the core spray nozzles will provide adequate assurance of acceptable fatigue usage of the core spray nozzle safe ends.

To address locations where the CUFs approach the allowable limit during the period of extended operation the applicant committed to implementing one or more of the actions that are specified in Commitment No. 43 and that are listed in the SER section 4.3.1.2.
Based on its review, the staff finds the applicant's response to RAI 4.3-9 acceptable because that applicant has provided an adequate summary of the F_{en} calculation for each component analyzed, including values of oxygen level, temperature and strain rate used in the F_{en} calculations and has sufficiently explained the basis for the oxygen level, temperature and strain rate values used in the F_{en} calculations. Therefore, the staff's concerns described in RAI 4.3-9 are resolved.

As indicated by the applicant, the use of an inspection program to manage fatigue will require prior staff review and approval. The SSES FMP will require that the applicant monitor the fatigue usage of the LRA Table 4.3-3 locations and take corrective actions if the CUF, including environmental effects at these locations, is projected to exceed the allowable value of 1.0, during the period of extended operation. The staff finds that the applicant's FMP provides an acceptable program to manage the effects of the reactor coolant environment on the fatigue life of the RCPB components, during the period of extended operation.

4.3.3.3 UFSAR Supplement

The applicant provided the UFSAR supplement summary description of its evaluation of effects of reactor coolant environment on fatigue life of components in LRA Section A.1.3.2.3. On the basis of its review of the UFSAR supplement, the staff finds that the applicant has provided an adequate summary of its environmental fatigue evaluation of RCPB components.

4.3.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of reactor coolant environment on fatigue life of RCPB components will be adequately managed during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.3.4 Reactor Coolant Pressure Boundary Piping and Component Fatigue Analyses

4.3.4.1 Summary of Technical Information in the Application

LRA Section 4.3.4 describes the SSES evaluation of reactor coolant pressure boundary piping and component fatigue analyses. The piping and components are all within Class 1 boundary. This includes all RCPB piping and in-line components subject to ASME Code Section XI, Subsection IWB, inspection requirements. The components are listed in this section of the LRA and are identified in the UFSAR as well. The SSES FMP monitors the design transients (considered in RCPB components fatigue analyses) and ensures that the fatigue values of selected RCPB components are within limits. In addition, the LRA stated that fatigue on the Class 1 valves would be managed indirectly by monitoring fatigue on the piping.

4.3.4.2 Staff Evaluation

In LRA Section 4.3.4, the applicant stated that the RCPB components are generally designed in compliance with ASME Code Section III, Subsection NB-3600. Subsection NB-3600 contains rules for the design of Class 1 piping systems, which require that the CUF be less than 1.0. The applicant provided the 60-year CUF projections for the limiting RCPB locations in LRA Table 4.3-2. This LRA Table shows that the projected CUFs at all Unit 1 and Unit 2 locations are less than 1.0. The staff finds these projected 60-year CUFs acceptable since they are within the ASME Code Section III acceptance limit of 1.0.

In addition to the ASME Code Section III, Subsection NB-3600 criteria, the applicant's high energy pipe break licensing basis criteria requires that the CUF be less than 0.1 in locations between the containment isolation valves (typically designated as the no-break zone). LRA Table 4.3-2 documents the projected 60-year CUF for the Unit 2 feedwater piping in the no-break zone at greater than 0.1. The applicant has committed to monitor the limiting locations in LRA Table 4.3-2, using the SSES Fatigue Monitoring Program. Further discussion of the pipe break criteria is provided in SER Section 4.7.2. To address locations where the CUFs approach the allowable limit during the period of extended operation the applicant committed to implementing one or more of the actions that are specified in Commitment No. 43 and that are listed in the SER section 4.3.1.2.

As indicated by the applicant, the use of an inspection program to manage fatigue will require prior staff review and approval. The SSES FMP will require that the applicant monitor the fatigue usage of the limiting RCPB components and take corrective actions, if the CUF of these components is projected to exceed the allowable value of 1.0 (or 0.1 in the no-break zone), during the period of extended operation. The staff finds the SSES FMP provides an acceptable program to manage the fatigue usage of the RCPB components during the period of extended operation.

The staff noted that applicant justified the monitoring of fatigue on piping as a way to monitor associated valves, by asserting that fatigue usage is typically much higher on the associated piping systems.

In RAI 4.3-5, dated July 3, 2008, the staff requested that the applicant provide the technical basis for that statement. The applicant's response indicated that ASME Class 1 valves are typically prepared by the valve manufacturer and are not analyzed as part of the piping system. The applicant reviewed a representative sample of ASME Class 1 valve design reports and found the fatigue usage factors of the valves were less than 0.1. These values were less than

the fatigue usage factors at the limiting piping locations presented in LRA Table 4.3-2. The staff finds the applicant's response, dated August 1, 2008, reasonable based on its review of previous LRAs which identified that the limiting RCPB piping fatigue usage factors were in the piping components at locations such as branch connection nozzles and piping material transition regions.

4.3.4.3 UFSAR Supplement

The applicant provided the UFSAR supplement summary description of its fatigue TLAA evaluation of the RCPB piping and components in LRA Section A.1.3.2.4. On the basis of its review of the UFSAR supplement, the staff finds that the applicant has provided an adequate summary description of the RCPB fatigue TLAA evaluation.

4.3.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended function(s) of RCPB components will be adequately managed during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.3.5 Non-Class 1 Component Fatigue Analyses

4.3.5.1 Summary of Technical Information in the Application

LRA Section 4.3.5 describes the SSES evaluation of non-Class 1 component fatigue analyses. The components included within this section are: pipe, tubing, fittings, tanks, vessels, heat exchangers, valve bodies and bonnets, pump casings, and miscellaneous process components. The applicant reviewed non-Class 1 components with operating temperatures above the specified threshold values. The applicant evaluated these components to determine the number of projected cycles for 60 years was found to be less than 7000 for piping and in-line components.

4.3.5.2 Staff Evaluation

In LRA Section 4.3.5, the applicant stated that explicit fatigue analyses were not required for the evaluation of non-Class 1 components. Instead, the piping design code contained a limit of 7000 equivalent full range thermal cycles. The applicant also stated that all non-Class 1 components above the specified temperature thresholds are projected to have less 7000 cycles.

In RAI 4.3-6, the staff requested that the applicant verify whether any of the numbers of projected cycles for piping and in-line components were derived for evaluation of "partial cycle" transients, where partial cycles are transient cycles that do not experience the full-temperature design cycles.

In its response to RAI 4.3-6, dated August 1, 2008, the applicant stated that the 60-year cycle projections assumed each event occurred at full-temperature design range and no partial cycles were used in the evaluation.

Based on its review, the staff finds the applicant's response to RAI 4.3-6 acceptable because the applicant has assumed the maximum range for each temperature cycle in its assessment. The staff also finds that the applicant has performed an acceptable evaluation of the non-Class 1 components for the period of extended operation. Therefore, the staff's concern described in RAI 4.3-6 is resolved.

4.3.5.3 UFSAR Supplement

The applicant provided the UFSAR supplement summary description of its fatigue TLAA evaluation of Non-Class 1 Component Fatigue Analyses in LRA Section A.1.3.3. On the basis of its review of the UFSAR supplement, the staff finds that the applicant has provided an adequate summary description of the fatigue TLAA evaluation non-Class 1 components.

4.3.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of Non-Class 1 components will remain valid during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.4 Environmental Qualification of Electrical Equipment

The 10 CFR 50.49 EQ program is a TLAA for purposes of license renewal. The TLAA of the EQ of electrical components includes all long-lived, passive, and active electrical and I&C components that are important to safety and are located in a harsh environment. The harsh environments of the plant are those areas subject to environmental effects by LOCAs or HELBs. EQ equipment comprises safety-related and Q-list equipment, nonsafety-related equipment the failure of which could prevent satisfactory accomplishment of any safety-related function, and necessary post-accident monitoring equipment.

As required by 10 CFR 54.21(c)(1), the applicant must provide a list of EQ TLAAs. The applicant shall demonstrate that for each type of EQ equipment, one of the following is true: (1) the analyses remain valid for the period of extended operation, (2) the analyses have been projected to the end of the period of extended operation, or (3) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.4.1 Summary of Technical Information in the Application

LRA Section 4.4 summarizes the evaluation of EQ of electrical equipment for the period of extended operation. The applicant states that SSES EQ program is in compliance with the requirement of 10 CFR 50.49, and is being used to manage the aging of equipment in the EQ program during the current license term. The existing SSES EQ program will be used to manage aging of equipment in the EQ program during the period of extended operation and includes provision to ensure that the qualification bases are maintained and the components do not exceed their qualified lives.

4.4.2 Staff Evaluation

The staff reviewed LRA Section 4.4 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff reviewed LRA Section 4.4 and plant basis documents to determine whether the applicant provided adequate information to meet the requirement of 10 CFR 54.21(c)(1). For the electrical equipments identified in the EQ master list, the applicant uses 10 CFR 54.21(c)(1)(iii) in its TLAA evaluation to demonstrate that the aging effects of EQ equipment will be adequately managed during the period of extended operation. The staff reviewed the applicant's EQ program to determine whether it will assure that the electrical and I&C components covered under this program will continue to perform their intended functions, consistent with the CLB, for the period of extended operation.

The staff's evaluation of the components qualification focused on how the EQ program manages the aging effects to meet the requirements pursuant to in 10 CFR 50.49.

The staff conducted an audit of the information provided in LRA Section B 3.2 and program basis documents. On the basis of its audit, the staff finds that the EQ program, which the applicant claimed to be consistent with GALL AMP X.E1, "Environment Qualification of Electrical Components," is consistent with the EQ program in the GALL Report. Therefore, the staff finds that the EQ program is capable of programmatically managing the qualified life of components within the scope of the program for license renewal. The continued implementation of the EQ program provides assurance that the aging effects will be managed and that components within the scope of the EQ program will continue to perform their intended functions for the period of extended operation.

4.4.3 UFSAR Supplement

In LRA Section A.1.3.4, the applicant provided an updated final safety analysis report (UFSAR) supplement of summary description of EQ of electrical equipment. This summary description is not consistent with that in SRP-LR Table 4.4.2 as it does not contain reanalysis attributes. Reanalysis must address attributes of the applicant's analytical methods; data collection and reduction methods; underlying assumptions; acceptance criteria; corrective actions, if acceptance criteria are not met; and the period of time, prior to the end of qualified life, when the reanalysis will be completed.

In RAI B.3.2-1, the staff requested that the applicant revise the UFSAR supplement description to include these reanalysis attributes.

In response to RAI B.3.2-1, dated August 5, 2008, the applicant stated that LRA Section A.1.3.4 is revised to include the reanalysis attributes as follows:

> A.1.3.4 Environmental Qualification of Electric Equipment
> Environmental Qualification analyses for those components with a qualified life of 40 years or greater are identified as TLAA for SSES. NRC regulation 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants" requires licensees to identify electrical equipment covered under this regulation and to maintain a qualification file

demonstrating that the equipment is qualified for its application and will perform its safety function up to the end of its qualified life.

10 CFR 50.49 requires EQ components that are not qualified for the current license term to be refurbished, replaced, or have their qualifications extended prior to reaching the aging limits established in the aging evaluation. Reanalysis of aging evaluations to extend the qualifications of components is performed on a routine basis as part of the EQ Program. Important attributes for the reanalysis of aging evaluations include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions (if acceptance criteria are not met), and the time remaining to the end of qualified life.

The SSES EQ Program is an existing program that implements the requirements of 10 CFR 50.49 and will be used to manage the effects of aging on the intended function(s) of the components associated with EQ TLAA for the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI B.3.2-1 acceptable because the applicant has revised the UFSAR supplement description to include the reanalysis attributes. Therefore, the staff's concern described in RAI B.3.2-1 is resolved.

With the amendment as described above, the applicant provides an adequate summary description of TLAA evaluation. This description is consistent with the guidance found in SRP-LR Table 4.4.2. On the basis of its review of the UFSAR supplement, the staff finds that the summary description of the applicant's actions to address EQ of electrical equipment is adequate, as required by 10 CFR 54.21(d).

4.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for EQ of electrical equipment, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.5 Concrete Containment Tendon Prestress

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 summarizes the evaluation of concrete containment tendon prestress for the period of extended operation. Units 1 and 2 have Mark II primary containments with no pre-stressed tendons; therefore, tendon prestress evaluations are not applicable.

4.5.2 Staff Evaluation

Units 1 and 2 containment has no prestressed tendons; therefore, the staff finds that this TLAA is not required.

4.5.3 UFSAR Supplement

The staff concludes that no UFSAR supplement is required because Units 1 and 2 has no pre-stressed tendons in the containment building.

4.5.4 Conclusion

On the basis of its review, as discussed above, the staff concludes this TLAA is not required.

4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analyses

4.6.1 ASME Code Class MC Components

4.6.1.1 Summary of Technical Information in the Application

LRA Section 4.6.1 summarizes the applicant's evaluation of fatigue of ASME Code Class MC components for the period of extended operation. Fatigue evaluations were required for analyses qualifying as TLAAs for the containment penetrations, hatches, and drywell head. The applicant states that it compared the design thermal cycles for those evaluations against the maximum projected thermal cycles for extended life to 60 years and determined that the penetration fatigue evaluations are adequate and require no updating for license renewal.

4.6.1.2 Staff Evaluation

The staff reviewed LRA Section 4.6.1, pursuant to 10 CFR 54.21(c)(1)(i), to verify that the analyses remain valid for the period of extended operation.

In LRA Section 4.6.1, the applicant stated that the design thermal cycles for ASME Code Class MC components are 500 cycles associated with plant startup and shutdown and one cycle for a DBA. The staff examined UFSAR Section 3.8.2, "ASME Class MC Steel Components of the Containment" and confirmed the design thermal cycles for the fatigue evaluation of the containment ASME Code Class MC stainless steel components.

The staff reviewed LRA Section 4.6.1 and the relevant references cited in the TLAA. The staff noted LRA states that the RPV assembly and internal components were designed for a combined total of 228 events for startup and shutdown for 40 years, and projected for a total of 296 cycles for extended life to 60 years. The staff finds that the 500 design cycles for startups and shutdowns remains well above the projected 60-year value, and the one cycle for DBA is assumed in the design for the life of the plant, whether that is 40 years or 60 years. On this basis, the staff agrees that the existing analysis of fatigue remains valid through the period of extended operation. The staff finds this TLAA acceptable because the projected 60-year thermal cycles are bounded by the design thermal cycles based on UFSAR Section 3.8.2.

4.6.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of fatigue for the containment ASME Code Class MC stainless steel components in LRA Section A.1.3.5.1. On the basis of its review of the UFSAR supplement, the staff finds that the

summary description of the applicant's actions to address fatigue of the containment ASME Code Class MC stainless steel components is adequate because the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1.

4.6.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that, for the containment ASME Code Class MC components fatigue TLAA, the analyses remain valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.6.2 Downcomer Vents and Safety Relief Valve Discharge Piping

4.6.2.1 Summary of Technical Information in the Application

LRA Section 4.6.2 summarizes the applicant's evaluation of fatigue for downcomer vents and SRV discharge piping for the period of extended operation. The applicant states that to ensure the integrity of the downcomers and SRV discharge piping for the original 40-year life of the plant, analyses were performed for the appropriate load combinations and their associated number of cycles. Fatigue evaluations were required for analyses qualifying as TLAAs. The applicant also states that it calculated the combined stress and corresponding equivalent stress cycles to obtain the fatigue CUF in accordance with the ASME Section III, Subsection NB-3600. In the SSES LRA, the applicant summarized the maximum CUF for the downcomers in Table 4.6-1 and for the SRV discharge piping in LRA Table 4.6-2. The applicant compared the number of events assumed in the 40-year design basis analyses against the projected 60-year number and determined that the fatigue evaluations are adequate and require no updating for license renewal.

4.6.2.2 Staff Evaluation

The staff reviewed LRA Section 4.6.2 pursuant to 10 CFR 54.21(c)(1)(i), to verify that the analyses remain valid for the period of extended operation.

During the review, the staff reviewed the applicant's related onsite basis documents to confirm the design cycles of downcomer vents and SRV discharge piping for the fatigue evaluation. In LRA Table 4.6-1, the applicant summarized the maximum CUF for the downcomers. However, the staff noted that Operational Cases Four and Six are identical, while the CUF values are different.

In RAI 4.6.2-1, dated June 17, 2008, the staff requested that the applicant clarify the discrepancy.

In its response to RAI 4.6.2-1, dated July 8, 2008, the applicant stated that the LRA Table 4.6-1 Maximum CUF for Downcomers described is incorrect and requires revision based on the Design Assessment Report for Units 1 and 2 The applicant amended the LRA to correctly identify Operational Case Six in Table 4.6-1 as "6-Emergency/Faulted – SBA:SRV+CHUG" to "Emergency/Faulted – SBA: CHUG+SSE."

Based on its review, the staff finds the applicant's response to RAI 4.6.2-1 acceptable because the applicant has amended LRA Table 4.6-1 to clarify the maximum downcomer CUF discrepancy. Therefore, the staff's concern described in RAI 4.6.2-1 is resolved.

The staff reviewed LRA Section 4.6.2, the related onsite basis documents, and the applicant's response to RAI 4.6.2-1. The staff notes that the applicant has summarized the maximum CUFs for downcomers with different operational cases in LRA Table 4.6-1, and the maximum CUFs for SRV discharge piping in the suppression pool area in LRA Table 4.6-2. The staff finds that all CUFs for both 40 years and 60 years are less than 1. The staff also finds that the number of cycles assumed in the applicant's design basis (40-year) for the both downcomer and SRV discharge piping remains above the projected 60-year number of events. On this basis, the staff agrees with the applicant that the existing analysis of fatigue remains valid through the period of extended operation.

The staff finds this TLAA acceptable because the 60-year anticipated number of events is bounded by the number assumed in the design basis analysis.

4.6.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the downcomer vents and SRV discharge piping in LRA Section A.1.3.5.2. On the basis of its review of the UFSAR supplement, the staff finds that the summary description of the applicant's actions to address fatigue for the downcomer vents and SRV discharge piping is adequate because the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1.

4.6.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that, for the downcomer vents and SRV discharge piping fatigue TLAA, the analyses remain valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.6.3 Safety Relief Valve Quenchers

4.6.3.1 Summary of Technical Information in the Application

LRA Section 4.6.3 summarizes the applicant's evaluation of SRV quenchers fatigue for the period of extended operation. The applicant states that to ensure the integrity of the SRV quenchers for the original 40-year life of the plant, two analyses were performed based on the number of allowable cycles, one using design loading, and the other using test loading data. Seven thousand cycles were assumed as design cycles for the components. Fatigue evaluations were required for analyses qualifying as TLAAs. The applicant calculated CUF for each analysis, and summarized the CUF for the SRV quenchers in LRA Table 4.6-3. The applicant further states that it compared the number of cycles assumed in the 40-year design basis analyses against the projected 60-year number from FatiguePro software and determined that the fatigue evaluations are adequate and require no updating for license renewal.

4.6.3.2 Staff Evaluation

The staff reviewed LRA Section 4.6.3, pursuant to 10 CFR 54.21(c)(1)(i), to verify that the analyses remain valid for the period of extended operation.

During the audit and review, the staff reviewed the applicant's related onsite basis documents to confirm the design cycles of the SRV quenchers for the fatigue evaluation. The staff noted that all components of the quenchers, except the base support which was designed as a "Code Paragraph NF" component support, were designed and analyzed in accordance with ASME Code Section III, Paragraph NC-3200, 1977 Edition with 1977 Summer Addenda. The staff is not clear which Code Paragraph NF the applicant referred to. In RAI 4.6.3-1, dated June 17, 2008, the staff requested that the applicant clarify which code was being referenced.

In its response to RAI 4.6.3-1, dated July 8, 2008, the applicant stated that LRA Section 4.6.3 is incorrect and "Code Paragraph NF" will be revised to "Code Subsection NF." The staff confirmed that that applicant has amended LRA Section 4.6.3 to reflect this change.

Based on its review, the staff finds the applicant's response to RAI 4.6.3-1 acceptable because the applicant has amended LRA Section 4.6.3 to correct the code reference. The staff confirms that Code Subsection NF is the correct reference. Therefore, the staff's concern described in RAI 4.6.3-1 is resolved

The staff reviewed LRA Section 4.6.3, the related onsite basis documents, and the applicant's response to RAI 4.6.3-1. The staff notes that the projected quencher cycles and CUFs are displayed in LRA Table 4.6.3. The staff finds that the expected number of cycles for each quencher component analyzed is 7000, and that all CUFs for both 40 years and 60 years are less than 1. The staff also finds that the number of design cycles for the SRV quenchers exceeds the number of projected 60-year cycles. On this basis, the staff agrees with the applicant that the existing analysis of fatigue remains valid through the period of extended operation. The staff finds this TLAA acceptable because the number of projected 60-year cycles is bounded by the number assumed in the design basis analysis.

4.6.3.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the SRV quenchers in LRA Section A.1.3.5.3. On the basis of its review of the UFSAR supplement, the staff finds that the summary description of the applicant's actions to address fatigue for the SRV quenchers is adequate because the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1.

4.6.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that, for the SRV quenchers fatigue TLAA, the analyses remain valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.7 Other Plant-Specific Time-Limited Aging Analyses

4.7.1 Main Steam Line Flow Restrictor Erosion Analyses

4.7.1.1 Summary of Technical Information in the Application

LRA Section 4.7.1 summarizes the evaluation of Main Steam Line (MSL) flow restrictor erosion analyses for the period of extended operation. A flow restrictor is incorporated in each MSL to limit flow to 200 percent of rated flow if a MSL ruptures outside containment. Flow restrictor erosion is a safety concern because it could impair flow restrictor ability to limit vessel blowdown following a MSL break. As erosion is a time-related phenomenon, analyses of its effect on flow restrictors over the 40-year life of the plant are TLAAs. According to UFSAR Section 5.4.4, flow restrictor cast stainless steel material has excellent resistance to erosion by high-velocity steam. Only very slow erosion occurs and such a slight enlargement of the flow restrictor opening has no safety significance. The UFSAR states that after 40 years of operation the choke flow through the restrictor would increase by no more than 5% due to erosion, implying a 5% increase in released radiological dose, insignificant for a postulated break in a MSL outside containment.

Another 20 years of operation will result in further erosion of the MSL flow restrictor throats, which can be extrapolated linearly from 40 to 60 years. This extrapolation is conservative because the rate of erosion is expected to decrease as the restrictor throat area increases (operation at extended power uprate conditions does not affect erosion rate significantly). Therefore, erosion for the 20 years of extended operation will be approximately half the erosion for the first 40 years, and the corresponding increase in steam flow will be approximately half of the increase (5 percent) in steam flow due to erosion at the end of 40 years, meaning that by the end of 60 years the increase in flow compared to flow at the beginning of life will be no more than 7.5 percent. Therefore, the released dose for the accident case at 60 years would be increased no more than 7.5 percent. Such an insignificant increase in dose over the analyzed case remains within regulatory limits, as indicated in UFSAR Section 15.6.4.5.3. Hence, MSL flow restrictor performance is not impacted significantly by additional erosion during the period of extended operation, and the potential effect of the degraded performance is acceptable.

4.7.1.2 Staff Evaluation

The staff reviewed LRA Section 4.7.1, to verify pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

The design safety function of the flow restrictors is to limit the radiological release outside of the drywell following a MSL break and prior to MS isolation valve closure.

In LRA Section 4.7.1, the applicant stated that erosion of the MSL flow restrictors during 40 years of operation would increase steam flow rate by no more than 5 percent, and an additional 20 years of operation could be linearly extrapolated for a total increase in steam flow (and therefore dose) of 7.5 percent. The applicant based the 5 percent increase on an erosion rate "as high as 0.004 inches per year" of the MS flow restrictor. In RAI 4.7.1-1a the staff requested that the applicant explain the basis for assuming an erosion rate of 0.004 inches per year and whether this rate was applicable for the term of extended operation. The staff also requested that the applicant clarify whether this assumption was conservative, realistic, or non-conservative.

In its response to RAI 4.7.1-1a dated October 16, 2007, the applicant provided its basis for an additional 20 years of operation that included justification for the assumed erosion rate of the MSL flow restrictors. In addition, the applicant submitted evidence verifying that there was sufficient margin on the acceptable dose limits, in the event of a radiological release outside of containment.

As justification for the assumed erosion rate over 20 years of extended operation, the applicant cited EPRI Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools (EPRI Tools), Revision 4, Appendix A, Section 3.1.6, on treated water. This EPRI guideline states that material loss due to erosion is possible only if the fluid stream contains particulate (or water droplets in two phase flow) that impinges upon the surface of the metal. The applicant stated that since the environment in the MSLs, at the location of the flow restrictors, is treated water in the form of steam (with only 0.1 to 0.2 percent moisture), virtually no water droplets exist in the steam to cause erosion. This assumption is supported by inspection results indicating no significant erosion damage in the MSLs at Units 1 and 2. The staff reviewed EPRI report TR-106611, "Flow Accelerated Corrosion in Power Plants," Revision 1 and notes that flow-accelerated corrosion (FAC) rates drop to essentially zero when the chromium content of the alloy is above 0.5 percent and the temperature is greater than 450°F. The report also states that type 304 stainless steel (which contains a minimum of 18 percent chromium) has more than 250 times greater resistance to FAC than carbon steel. The MSL flow restrictors in question are constructed of cast austenitic stainless steel (American Society for Testing of Materials A351 Grade CF8), which contains a minimum of 18 percent chromium, and typically operate at a steam temperature of 543°F. The staff determined that the applicant's FAC program inspection of the carbon steel piping immediately downstream of the flow restrictors on Unit 2, showed the highest wear rate to be 0.019 inches per year, which is only about five times higher than the assumed wear rate of the stainless steel flow restrictors. When compared to the nominal ratio of 250 times given in the EPRI report, the staff finds that there is sufficient margin to assume that the 0.004 inches per year FAC rate is a very conservative value. Based on the information provided by the applicant, the staff finds the justification for the assumed erosion rate acceptable.

The staff performed an evaluation of the Control Room Habitability Envelope and of the offsite radiological doses (at the exclusion area boundary and the low population zone) following a MSL break, outside of containment, using the Alternative Source Term methodology described in RG 1.183. This methodology assumed a mass release that was a 20 percent increase over the original licensing value. This assumption provides additional margin for the extended power uprate, for which the applicant had submitted a separate license amendment. The Alternative Source Term methodology demonstrated that the highest ratio of any calculated dose to its acceptance criteria is 18.6 percent. Therefore, even with the 20 percent flow increase, a safety margin on the doses of at least 81.4 percent still remained. The staff determined that the additional 20 percent margin was unnecessary, because documented results demonstrate that a mass release following a MSL break will not increase (SSES PUSAR submittal, PLA-6076). The staff determines that an increase of 7.8 percent in the mass release from a postulated steam line break is acceptable because it is enveloped by the 20 percent increase considered in the extended power uprate evaluation, which was subsequently determined to be unnecessary.

In LRA Section 4.7.1, the applicant stated that any erosion that occurs will increase the throat cross-sectional area, thereby decreasing flow velocity and, thus, decrease the actual wear rate.

Therefore, the initial assumed wear rate of 0.004 inches per year will remain conservative for the period of extended operation. In RAI 4.7.1-1b, the staff requested that the applicant provide a copy of its calculation that demonstrated the acceptability of the MS flow restrictors for the license renewal period. The staff also requested that the applicant provide descriptions of all relevant parameters and, a basis and justification for all assumptions.

In its response to RAI 4.7.1-1b, dated October 16, 2007, the applicant stated that with an erosion rate of 0.004 inches per year, the throat diameter of the MSL flow restrictor's venturi section would increase by 0.480 inches (0.004 x 2 x 60) over the course of 60 years. Because the flow restrictor had an original throat diameter of 12.580 inches, the final diameter would be 13.060 inches (12.580 + 0.480) after 60 years. This would increase the throat area of the flow restrictor by 7.8 percent, and, because the flow is proportional to the throat area, the flow through the restrictor following a MSL break would increase by 7.8 percent. The staff finds the response to RAI 4.7.1-1b acceptable.

4.7.1.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of MSL flow restrictor erosion analyses in LRA Section A.1.3.6. On the basis of its review of the UFSAR supplement, the staff finds that the summary description of the applicant's actions to address MSL flow restrictor erosion analyses is adequate.

4.7.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for the MSL flow restrictor erosion analyses, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.7.2 High Energy Line Break Cumulative Fatigue Usage Factors

4.7.2.1 Summary of Technical Information in the Application

LRA Section 4.7.2 discusses the evaluation of TLAAs associated with the postulation HELBs. The SSES design criteria used to determine postulated HELB design locations included the calculated fatigue CUF based on the number of design transients assumed for the original 40-year life of the plant. Postulated pipe breaks were evaluated at locations where the design CUF was greater than 0.1. The applicant indicated that additional locations could exceed the CUF criteria in 60 years. The applicant will use the SSES FMP to monitor the fatigue usage of the piping systems and to determine whether any additional locations exceed the pipe break criteria during the period of extended operation.

4.7.2.2 Staff Evaluation

In LRA Section 4.7.2, the applicant stated that its FMP will be used to monitor the fatigue usage of piping systems during the period of extended operation. The applicant also stated that appropriate corrective actions would be taken to address any new locations where the CUF is projected to exceed 0.1, during the period of extended operation.

In RAI 4.7.2-1, dated September 5, 2007, the staff requested that the applicant clarify whether any Class 1 high-energy piping locations with a CUF value of less than 0.1, by the current design basis, may exceed 0.1 during the period of extended operation.

In its response to RAI 4.7.2-1, dated August 1, 2008, the applicant stated that there are additional locations where the CUF may exceed 0.1 during the period of extended operation. The applicant further stated that its FMP will be enhanced to ensure that high-energy piping systems continue to meet the applicable pipe break criteria, as specified in UFSAR Section 3.6, during the period of extended operation. The staff confirms that the applicant has revised Commitment No. 43 to enhance the SSES FMP as part of its response to RAI B.3.1-4. The revised commitment contains a provision to review HELB evaluations.

The staff finds the applicant's revised Commitment No. 43 to enhance the SSES FMP adequately addresses the TLAA associated with high energy pipe breaks. Therefore, the staff's concern described in RAI 4.7.2-1 is resolved.

4.7.2.3 UFSAR Supplement

The applicant provided the UFSAR supplement summary description of its TLAA evaluation of HELB CUFs in LRA Section 1.3.6.2. On the basis of its review of the UFSAR supplement, the staff finds the summary description of the applicant's actions to address the TLAA associated with postulated piping rupture locations due to fatigue usage is adequate.

4.7.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the fatigue analysis of RCPB components, including the fatigue criteria for postulation of high-energy pipe breaks, will be adequately managed during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.7.3 Core Plate Rim Hold-Down Bolts

4.7.3.1 Summary of Technical Information in the Application

LRA Section 4.7.3 summarizes the evaluation of core plate rim hold-down bolts for the period of extended operation. The SER that refers to BWRVIP-25, "BWR Core Plate Inspection and Flaw Evaluation Guidelines," for license renewal indicates loss of preload on the core plate rim hold-down bolts as one TLAA that must be addressed by applicants seeking license renewal. BWRVIP-25, Appendix B states that the core plate bolts will have at least 81-percent preload remaining at 54 EFPY. The applicant determined that loss of preload due to non-irradiation effects was negligible.

GE extended power uprate analyses evaluated the core plate hold-down bolts and determined that the preload at the end of 60 years would be adequate to prevent lateral motion of the core plate.

4.7.3.2 Staff Evaluation

The staff reviewed LRA Section 4.7.3, to verify pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

In LRA Section 4.7.3, the applicant stated that based on BWRVIP-25, the core plate bolts will have at least 81 percent preload remaining at 54 EFPY. The applicant further stated that the GE extended power uprate analyses, which evaluated the core plate hold-down bolts, showed that the preload at the end of 60 years would be adequate to prevent lateral motion of the core plate for the period of extended operation. The staff notes that this conclusion is not supported by any SSES plant-specific evaluation.

In RAI 4.7.3-1, dated September 5, 2007, the staff requested that the applicant:

(1) Demonstrate the applicability of the BWRVIP-25 loss of preload analysis to the Susquehanna units. Identify the temperature of the bolts during the normal operation and the projected bolt neutron fluence at the end of the period of extended operation for the Susquehanna units. Provide a plant-specific evaluation demonstrating that the loss of preload due to stress relaxation for the Susquehanna RPV core plate hold-down bolts is bounded by the value of 19 percent from BWRVIP-25 Appendix B.

(2) Perform a plant-specific core plate hold-down bolt analysis using the BWRVIP-25 Appendix A methodology, demonstrating that the axial and bending stresses for the mean and highest loaded hold-down bolts will not exceed the ASME Code Section III allowable stresses for P_m (primary membrane) and $P_m + P_b$ (primary membrane plus bending) as a result of a plant-specific reduction in the bolt preload at the end of the extended period of operation. State the assumptions on which the plant-specific analysis was based.

(3) Provide sufficient information regarding the GE extended power uprate analyses on the core plate hold-down bolts mentioned in LRA Section 4.7.3 so that the staff can determine whether the Susquehanna hold-down bolts are adequate to prevent lateral motion of the core plate for the period of extended operation.

In its response to RAI 4.7.3-1, dated October 18, 2007, items 1 and 2, dated October 18, 2007, the applicant stated that it proposes to address the loss of preload on the core plate rim hold-down bolts, prior to entering the period of extended operation, by one of the following two actions:

(1) Perform an SSES plant-specific evaluation consistent with BWRVIP-25 to demonstrate that the core plate rim hold-down bolts will be capable of preventing lateral displacement of the core plate for the period of extended operation. The evaluation will determine the maximum expected reduction in the bolt preload at the end of the period of extended operation, considering all applicable parameters (*i.e.*, operating temperature, operating loads, and irradiation effects) and demonstrate the acceptability of the final preload at the end of the period of extended operation. Using the methodology of BWRVIP-25 Appendix A, the evaluation will also determine the primary membrane and bending stresses for the limiting bolt(s) to demonstrate that ASME Code allowables are not exceeded

as a result of the reduction in bolt preload at the end of the period of extended operation. The evaluation will be submitted to the staff for review no less than two years prior to the period of extended operation.

(2) Install core plate wedges to structurally replace the lateral load resistance provided by the hold-down bolts. With wedges installed, any loss of preload on the core plate rim hold-down bolts during the period of extended operation will have no effect on the lateral stability of the core plate.

The applicant further stated that if the evaluation described as (1) above is unable to demonstrate acceptable bolt preload or bolt stress values at the end of the period of extended operation, appropriate corrective action will be taken prior to entering the period of extended operation. These proposed measures are summarized in Disposition of LRA Section 4.7.3, UFSAR Supplement Section A.1.3.6.3, and a new commitment in LRA Table A-1.

Based on its review, the staff finds the applicant's response to RAI 4.7.3-1 acceptable because the applicant has committed (Commitment No. 55) to address the loss of preload on the core plate rim hold-down bolts, prior to entering the period of extended operation. The staff reviewed the applicant's commitment and concludes that conducting the proposed plant-specific analysis, consistent with BWRVIP-25 guidance, is an acceptable method of addressing the TLAA for the core plate rim hold-down bolts, as described in the SER for compliance with the license renewal rule, dated December 7, 2000. The staff also concludes that installation of core plate wedges is considered an appropriate corrective action, consistent with BWRVIP-25, as described in the SER for operating plants, dated December 19, 1999. Either action will provide adequate assurance that the 60-year stress relaxation of the core plate hold-down bolts, due to neutron exposure, will not compromise the structural integrity and operability of the core plate to the end of the period of extended operation. The staff determines that since the plant-specific analysis described by the applicant in action (1) will consider applicable irradiation effects not based on the GE extended power uprate report, item (3) of the RAI is no longer a concern. Therefore, the staff's concerns described in RAI 4.7.3-1 are resolved.

4.7.3.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of core plate rim hold-down bolts in LRA Section A.1.3.6. On the basis of its review of the revised UFSAR supplement, the staff finds that the summary description of the applicant's actions to address core plate rim hold-down bolts is adequate.

4.7.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant's Commitment No. 55 to provide a plant-specific TLAA analysis on the stress relaxation of the core plate rim hold-down bolts for the period of extended operation, two years prior to the start of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii), is acceptable. Further, the non-TLAA alternative of installing core plate wedges as structural replacements for the lateral load resistance, provided by the hold-down bolts, is considered acceptable. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and therefore is acceptable.

4.8 Conclusion for Time-Limited Aging Analyses

The staff reviewed the information in LRA Section 4, "Time-Limited Aging Analyses." On the basis of its review, the staff concludes, that the applicant has provided a sufficient list of TLAAs, as defined in 10 CFR 54.3 and that the applicant has demonstrated that: (1) the TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i); (2) the TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii); or (3) that the effects of aging on intended function(s) will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff also reviewed the UFSAR supplement for the TLAAs and finds that the supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, as required by 10 CFR 54.21(c)(2) that no plant-specific, TLAA-based exemptions are in effect.

With regard to these matters, the staff concludes that there is reasonable assurance that the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB, and that any changes made to the CLB, in order to comply with 10 CFR 54.29(a), are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 5

REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The NRC staff issued its safety evaluation report (SER) with open items related to the renewal of the operating license of Susquehanna Steam Electric Station (SSES), Units 1 and 2 on March 13, 2009. On April 1, 2009, the applicant presented its license renewal application, and the staff presented its review findings to the ACRS Plant License Renewal Subcommittee. The staff reviewed the applicant's comments on the SER and completed its review of the license renewal application. The staff's evaluation is documented in an SER that was issued by letter dated August 27, 2009.

During the 566st meeting of the ACRS, October 8, 2009, the ACRS completed its review of the SSES license renewal application and the NRC staff's SER. The ACRS documented its findings in a letter to the Commission dated October 23, 2009. A copy of this letter is provided on the following pages of this SER Section.



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

October 23, 2009

The Honorable Gregory B. Jaczko
Chairman
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL APPLICATION FOR THE SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2

Dear Chairman Jaczko:

During the 566th meeting of the Advisory Committee on Reactor Safeguards, October 8-10, 2009, we completed our review of the license renewal application for the Susquehanna Steam Electric Station (SSES), Units 1 and 2, and the final Safety Evaluation Report (SER) prepared by the NRC staff. Our Plant License Renewal Subcommittee also reviewed this matter during its meeting on April 1, 2009. During these reviews, we had the benefit of discussions with representatives of the NRC staff and the applicant, PPL Susquehanna, LLC (PPL). We also had the benefit of the documents referenced. This report fulfills the requirement of 10 CFR 54.25 that the ACRS review and report on all license renewal applications.

CONCLUSION AND RECOMMENDATION

1. The programs established and committed to by the applicant to manage age-related degradation provide reasonable assurance that SSES, Units 1 and 2 can be operated in accordance with its current licensing basis for the period of extended operation without undue risk to the health and safety of the public.

2. The PPL application for renewal of the operating licenses of SSES, Units 1 and 2 should be approved.

BACKGROUND AND DISCUSSION

SSES consists of two General Electric Model 4 boiling water reactors (BWR-4) with Mark II containments and is located approximately 5 miles northeast of Berwick, Pennsylvania. In 2008, the NRC authorized an extended power uprate to increase the maximum power level for SSES, Units 1 and 2 from 3,489 MWt to 3,952 MWt. The gross electrical output of each reactor is approximately 1,300 megawatts-electric. The relevant evaluations of the license renewal application have been performed at the extended power conditions. PPL requested renewal of the SSES, Units 1 and 2 operating licenses for 20 years beyond the current license terms, which expire on July 17, 2022, for Unit 1, and on March 23, 2024, for Unit 2.

In the final SER, the staff documented its review of the license renewal application and other information submitted by the applicant or obtained from the staff audits and inspections at the plant site. The staff reviewed the completeness of the applicant's identification of the structures, systems, and components (SSCs) that are within the scope of license renewal; the integrated plant assessment process; the applicant's identification of the plausible aging mechanisms associated with passive, long-lived components; the adequacy of the applicants Aging Management Programs (AMPs); and the identification and assessment of time-limited aging analyses (TLAAs) requiring review.

In the SSES license renewal application, PPL identified the SSCs that fall within the scope of license renewal. For these SSCs, the applicant performed a comprehensive aging management review. Based on this review, the applicant will implement 52 AMPs for license renewal, which include existing, new, and enhanced programs. Thirteen programs have exceptions to the corresponding programs described in the Generic Aging Lessons Learned (GALL) Report. Four of the programs are plant specific programs that do not have counterparts in the GALL Report.

The PPL application either demonstrates consistency with the GALL Report or documents deviations to the approaches specified in that Report. As noted above, 13 of the AMPs include exceptions to the corresponding programs in the GALL Report. We reviewed these exceptions and agree with the staff that they are acceptable. The staff conducted two license renewal audits and two inspections at the SSES site. The audits verified the appropriateness of the scoping and screening methodology, AMPs, aging management review, and TLAAs. The inspections verified that the license renewal requirements are appropriately implemented. Based on the audits and inspections, the staff concluded in the final SER that the proposed activities will adequately manage the effects of aging of SSCs identified in the application and that the intended functions of these SSCs will be maintained during the period of extended operation. We agree with this conclusion.

The staff's review of the applicant's operating experience revealed that inaccessible medium-voltage cables in certain manholes at SSES have experienced significant exposure to water, i.e., cable in standing water for more than a few days. In addition, during a walk down, the staff found several feet of water in Manhole Numbers 2 and 16. The staff identified water in manholes as a generic, current operating plant issue in Information Notice 2002-12, "Submerged Safety-Related Electrical Cables," and Generic Letter 2007-01, "Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients." The staff will resolve the issue of water in manholes during the current period of operation through the Reactor Oversight Process, in accordance with the requirements of 10 CFR Part 50.

PPL has committed to implement a Non-EQ Inaccessible Medium-Voltage Cables Program involving two parts: first, inspection (and draining, if necessary) of the applicable manholes on a periodic basis; and second, the development of a testing program to confirm that the conductor insulation on the applicable cables is not degrading. This program applies to six cables associated with the offsite power supply for SSES. These are the only inaccessible medium-voltage cables at SSES that are within the scope of license renewal. These cables are exposed to significant moisture and are energized more than 25% of the time. The Non-EQ Inaccessible Medium-Voltage Cable Program is a new AMP which will require the applicant to

test the cables and to evaluate plant-specific operating experience to determine an appropriate inspection frequency for the manholes.

The staff has determined that implementation of the Non-EQ Inaccessible Medium-Voltage Cable Program will ensure that the aging effects on inaccessible medium-voltage cables will be adequately managed during the period of extended operation. We agree with this conclusion. The applicant identified the systems and components requiring TLAAs and reevaluated them for the period of extended operation. The staff concluded that the applicant has provided an adequate list of TLAAs. Further, the staff concluded that the applicant has met the requirements of the License Renewal Rule by demonstrating that the TLAAs will remain valid for the period of extended operation; or the TLAAs have been projected to the end of the period of extended operation; or the aging effects will be adequately managed for the period of extended operation.

We agree with the staff that there are no issues related to the matters described in 10 CFR 54.29(a)(1) and (a)(2) that preclude renewal of the operating licenses for SSES, Units 1 and 2. The programs established and committed to by PPL provide reasonable assurance that the SSES can be operated in accordance with its current licensing basis for the period of extended operation without undue risk to the health and safety of the public. The PPL application for renewal of the operating licenses for SSES, Units 1 and 2 should be approved.

Sincerely,

Mario V. Bonaca
Chairman

SECTION 6

CONCLUSION

The staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff) reviewed the license renewal application (LRA) for Susquehanna Steam Electric Station, Units 1 and 2, in accordance with NRC regulations and NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated September 2005. Title 10, Section 54.29, of the *Code of Federal Regulations* (10 CFR 54.29) sets the standards for issuance of a renewed license.

On the basis of its review of the LRA, the staff determines that the requirements of 10 CFR 54.29(a) have been met.

The staff noted that any requirements of 10 CFR Part 51, Subpart A, are documented in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)," Supplement 35 "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Susquehanna Steam Electric Station, Units 1 and 2, Final Report" dated March 2009.

Appendix A

APPENDIX A

SSES UNITS 1 AND 2 LICENSE RENEWAL COMMITMENTS

During the review of the Susquehanna Steam Electric Station (SSES), Units 1 and 2, license renewal application (LRA) by the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff), PPL Susquehanna, LLC (the applicant) made commitments related to aging management programs (AMPs) to manage aging effects for structures and components. The following table lists these commitments along with the implementation schedules and sources for each commitment.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
1) Inservice Inspection (ISI) Program	Existing program is credited.	A.1.2.23	Ongoing
2) BWR Water Chemistry Program	Existing program is credited.	A.1.2.11	Ongoing
3) Reactor Head Closure Studs Program	Existing program is credited.	A.1.2.40	Ongoing
4) BWR Vessel ID Attachment Welds Program	Existing program is credited.	A.1.2.9	Ongoing
5) BWR Feedwater Nozzle Program	Existing program is credited.	A.1.2.6	Ongoing
6) BWR CRD Return Line Nozzle Program	Existing program is credited. • PPL will implement weld overlay repairs in accordance with ASME Section XI and NRC-approved Code Cases. If no NRC-approved Code Case exists for the weld overlay, PPL will obtain NRC approval prior to implementing the repair in accordance with 10 CFR 50.55a.	A.1.2.5	Ongoing
7) BWR Stress Corrosion Cracking (SCC) Program	Existing program is credited.	A.1.2.8	Ongoing

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
8) BWR Penetrations Program	Existing program is credited.	A.1.2.7	Ongoing
9) BWR Vessel Internals Program	Existing program is credited. • PPL will continue to perform inspections on at least 10% of the top guide grid beam cells containing control rod drives/blades every twelve years during the period of extended operation. Inspections on at least 5% of the top guide locations will be performed within the first six years of each twelve year interval. The top guide locations to be inspected are those subject to neutron fluence levels that exceed the IASCC threshold of 5.0E+20 n/cm^2. The inspections will be performed using the enhanced visual inspection technique, EVT-1.	A.1.2.10	Ongoing
10) Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS) Program	Program is new. The new program for SSES will be consistent with the program described in NUREG-1801 Section XI.M13, Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. The SSES program will identify susceptible components, evaluate those components to determine their susceptibility to loss of fracture toughness, and examine those components that are evaluated to be susceptible.	A.1.2.48	Prior to the period of extended operation.
11) Flow-Accelerated Corrosion (FAC) Program	Existing program is credited.	A.1.2.20	Ongoing

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
12) Bolting Integrity Program	Existing program is credited with the following enhancement: • Include specific precautions against the use of sulfur (sulfide) containing compounds as a lubricant for bolted connections.	A.1.2.2	Prior to the period of extended operation
13) Piping Corrosion Program	Existing program is credited with the following enhancements: • Include the Standby Gas Treatment System loop seals within the scope of the program. • Incorporate performance, documentation and trending of opportunistic visual inspections (during normal maintenance/repair activities) in addition to existing Piping Corrosion Program inspections.	A.1.2.38	Prior to the period of extended operation.
14) Crane Inspection Program	Existing program is credited.	A.1.2.17	Ongoing
15) Fire Protection Program	Existing program is credited.	A.1.2.18	Ongoing
16) Buried Piping Surveillance Program	Program is new. The scope of the Buried Piping Surveillance Program includes only the portions of the buried piping in the Residual Heat Removal Service Water (RHRSW) and Emergency Service Water (ESW) common return header known to have damaged coatings. The program is credited for managing loss of material due to crevice, general, and pitting corrosion and microbiologically influenced corrosion (MIC) for buried steel piping components with damaged coatings.	A.1.2.4	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
17) Condensate and Refueling Water Storage Tanks Inspection	Program is a new one-time inspection. The scope of the Condensate and Refueling Water Storage Tanks Inspection includes the base (bottom surface and foundation pad interface) of the Condensate Storage Tanks (CSTs) and Refueling Water Storage Tank (RWST) that are in the scope of license renewal and included in the Condensate Storage and Transfer and the Refueling Water Storage and Transfer systems. An appropriate combination of volumetric (including thickness measurement) and visual examinations will be conducted, for a unit's CST (or RWST), to detect evidence of a loss of material due to crevice, general, or pitting corrosion or to confirm a lack thereof. Results will be applied to the other unit's tank(s) based on engineering evaluation.	A.1.2.14	Within the 10-year period prior to the period of extended operation.
18) Reactor Vessel Surveillance Program	Existing program is credited with the following enhancement: Address the additional requirements specified in the NRC safety evaluation dated March 1, 2006, for BWRVIP-116. The program will include a requirement that, if a standby capsule is removed from either of the SSES Unit 1 or Unit 2 reactor vessels without the intent to test it, the capsule will be stored in a manner which maintains it in a condition which would permit its future use, including during the period of extended operation if necessary.	A.1.2.41	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
19) Chemistry Program Effectiveness Inspection	Program is a new one-time inspection. The Chemistry Program Effectiveness Inspection includes the internal surfaces of aluminum, copper and copper alloy, carbon and low alloy steel, cast iron, stainless steel, and nickel alloy components in systems that contain treated water or fuel oil. A representative sample of components in low flow and stagnant areas (i.e., locations that are isolated from the flow stream and possibly prone to gradual accumulation/concentration of contaminants) will be examined for evidence of a loss of material (due to crevice, galvanic, general, or pitting corrosion or to erosion, and to MIC in fuel oil), or to confirm a lack thereof, and the results applied to the rest of the system(s) based on engineering evaluation.	A.1.2.12	Within the 10-year period prior to the period of extended operation.
20) Cooling Units Inspection	Program is a new one-time inspection. The Cooling Units Inspection activities focus on a representative sample population of subject components at susceptible locations, to be defined in the implementing documents. These inspection activities provide symptomatic evidence of cracking, loss of material, or reduction in heat transfer at all other susceptible locations due to the similarities in materials and environmental conditions.	A.1.2.16	Within the 10-year period prior to the period of extended operation.
21) Heat Exchanger Inspection	Program is a new one-time inspection. The Heat Exchanger Inspection detects and characterizes conditions to determine whether, and to what extent a loss of heat transfer due to fouling is occurring (or likely to occur) for heat exchangers within the scope of license renewal. The Heat Exchanger Inspection is also credited for managing cracking due to stress corrosion cracking / inter-granular attack in the treated water (internal) environment of the admiralty brass tubes.	A.1.2.22	Within the 10-year period prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
22) ----------	This commitment for Main Steam Flow Restrictor Inspection was removed.	----------	----------
23) Monitoring and Collection System Inspection	Program is a new one-time inspection. The scope of the Monitoring and Collection System Inspection includes the internal surfaces of subject carbon steel (and low alloy steel) and cast iron piping and valve bodies that are exposed to potentially radioactive drainage water (untreated water) and potentially other contaminants/fluids during normal plant operations. A representative sample of components in the system, to be defined in the implementing documents, and to include containment isolation piping and/or valve bodies, will be examined for evidence of a loss of material (due to crevice, general, or pitting corrosion or to MIC), or to confirm a lack thereof, and the results applied to the rest of the system based on engineering evaluation.	A.1.2.33	Within the 10-year period prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
24) Supplemental Piping/Tank Inspection	Program is a new one-time inspection. The Supplemental Piping/Tank Inspection is credited for managing loss of material due to crevice and pitting corrosion on carbon steel surfaces at air-water interfaces. The inspection is also credited for managing loss of material due to microbiologically influenced corrosion (MIC) at the air-water interface with the mist eliminator loop seal, which is filled with raw water from the Service Water System, and galvanic corrosion at points of contact between the mist eliminator housing and the SGTS filter enclosure, where condensation and water pooling may occur. Additionally, the Supplemental Piping/Tank Inspection detects and characterizes whether, and to what extent, a loss of material due to crevice and pitting corrosion is occurring (or is likely to occur) for stainless steel surfaces at air-water interfaces. The Supplemental Piping/Tank Inspection also detects and characterizes loss of material due to crevice, galvanic, general, and pitting corrosion on internal carbon steel surfaces within the scram discharge volume (piping and valve bodies) of the Control Rod Drive Hydraulic System, within the air space of the condensate storage tanks and within the Diesel Generator starting air receiver tanks and E diesel compressor skid air receiver tanks to determine whether, and to what extent, degradation is occurring (or is likely to occur). In addition, the Supplemental Piping/Tank Inspection is credited to detect and characterize loss of material due to general, crevice, and pitting corrosion on the internal surfaces of carbon steel and cast iron diesel exhaust piping, piping components, and turbocharger casings.The inspection is also credited to detect and characterize cracking and loss of	A.1.2.46	Within the 10-year period prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
	material due to crevice and pitting corrosion on the internal surfaces of stainless steel diesel exhaust piping components.		
25) Selective Leaching Inspection	Program is a new one-time inspection. The Selective Leaching Inspection detects and characterizes conditions to determine whether, and to what extent a loss of material due to selective leaching is occurring (or likely to occur) for susceptible components including piping and tubing, valve bodies, pump and turbocharger casings, heat exchanger, cooler, and chiller components, hydrants, sprinkler heads, strainers, level gauges, orifices, and heater sheaths. The components within the scope of the program are formed of cast iron, brass, bronze, and copper alloy materials. The components are subject to raw water, treated water, groundwater (buried), indoor air with condensation, outdoor air, and fuel oil environments. The components within the scope of this program are located in twenty-six different plant systems.	A.1.2.43	Within the 10-year period prior to the period of extended operation.
26) Buried Piping and Tanks Inspection Program	Program is new. The scope of the Buried Piping and Tanks Inspection Program includes buried components that are within the scope of license renewal for SSES. The program is credited for managing loss of material due to crevice, general, and pitting corrosion and microbiologically influenced corrosion (MIC) for buried steel piping components. In addition, the program is credited with managing loss of material for buried stainless steel piping components. The Buried Piping and Tanks Inspection Program is also credited for managing loss of material due to crevice, general, and pitting corrosion and microbiologically influenced corrosion (MIC) for buried steel tanks in the Diesel Fuel Oil System.	A.1.2.3	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
27) Small-Bore Class 1 Piping Inspection	Program is a new one-time inspection. The SSES program will include measures to verify that cracking is not occurring in Class 1 small-bore piping, thereby validating the effectiveness of the Chemistry Program to mitigate cracking and confirming that no additional aging management programs are needed for the period of extended operation.	A.1.2.44	Within the 10-year period prior to the period of extended operation.
28) System Walkdown Program	Existing program is credited with the following enhancements: • The governing procedure for the System Walkdown Program must be revised to add the listing of systems crediting the program for license renewal and to explicitly include inspection of other metals, copper alloy and stainless steel. o It may be determined by engineering evaluation that these components do not require monitoring every two weeks, and the basis for a different walkdown frequency must be documented on the appropriate procedure form. • The governing procedure for the System Walkdown Program must be enhanced to address the license renewal requirement for opportunistic inspections of normally inaccessible components (e.g., those that are insulated), and those that are accessible only during refueling outages. For underground vaults/pits/manholes, an initial sample of at least one vault/pit/manhole from each grouping of components with identical material and environment combinations will be inspected prior to entering the period of extended operation. A representative sample of the entire population will be inspected within the first 6 years of the	A.1.2.47	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
28) System Walkdown Program (cont'd)	period of extended operation. Results of the inspection activities that require further engineering evaluation/resolution (e.g., sample expansion and inspection frequency changes if degradation is detected), if any, will be evaluated using the SSES corrective action process. The governing procedure for the System Walkdown Program will be enhanced to include a visual and ultrasonic inspection of the external surfaces of piping passing into structures through penetrations (underground piping) for those penetrations with a history of leakage. These inspections will be focused on penetrations that are leaking at that time and will include a representative population of each material, environment combination from those piping systems within the scope of license renewal (which includes those for the RHRSW, ESW, and Fire Protection systems) that enter structures below grade. • A routine activity to supplement the existing plant program will be generated, and based at least in part on EPRI 1007933, "Aging Assessment Field Guide," to inspect elastomers and polymers for cracking and/or change in material properties. Evidence of surface degradation, such as cracking or discoloration, as well as physical manipulation and/or prodding, will be used as a measure of the material condition. A representative sample will be determined by engineering evaluation with a focus on components considered to be most susceptible to aging, such as due to their time in service, the severity of conditions during normal plant operations, and any pertinent design margins.		

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
29) Inservice Inspection (ISI) Program – IWE	Existing program is credited.	A.1.2.24	Ongoing
30) Inservice Inspection (ISI) Program – IWF	Existing program is credited.	A.1.2.25	Ongoing
31) Inservice Inspection (ISI) Program - IWL	Existing program is credited.	A.1.2.26	Ongoing
32) Containment Leakage Rate Test Program	Existing program is credited.	A.1.2.15	Ongoing
33) Masonry Wall Program	Existing program is credited with the following enhancement: • Specify that for each masonry wall, the extent of observed masonry cracking and/or degradation of steel edge supports/bracing is evaluated to ensure that the current evaluation basis is still valid. Corrective action is required if the extent of masonry cracking and steel degradation is sufficient to invalidate the evaluation basis.	A.1.2.31	Prior to the period of extended operation.
34) Structures Monitoring Program	Existing program is credited with the following enhancements: Include additional structures requiring aging management for license renewal to the scope of the inspections.	A.1.2.45	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
34) Structures Monitoring Program (cont'd)	• Specify that if a below grade structural wall or structural component becomes accessible through excavation; a follow-up action is initiated for the responsible engineer to inspect the exposed surfaces for age-related degradation. • Clarify "structural component" for inspection includes each of the component types identified as requiring aging management. • Include degradation mechanisms for elastomer and earthen embankment inspection. • Include RG 1.127 inspection elements for water-control structure. • Specify that the responsible engineer shall review site groundwater and raw water pH, chlorides, and sulfates results prior to inspection to validate that the below-grade or raw water environment remain non-aggressive during the period of extended operation. • Specify that for each masonry wall, the extent of observed masonry cracking and/or degradation of steel edge supports/bracing is evaluated to ensure that the current evaluation basis is still valid. Corrective action is required if the extent of masonry cracking and steel degradation is sufficient to invalidate the evaluation basis. • Include additional direction for quantifying, monitoring and trending of inspection results; Include additional guidance for inspection reporting, data collection and documentation; Specify acceptance criteria and critical parameters to monitor degradation and to trigger level of inspection and initiation of corrective action; and provide		

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
	better alignment with referenced Industry codes, standards and guidelines. • Include specific qualification requirements for the inspector.		
35) RG 1.127 Water-Control Structures Inspection	Existing program is credited with the following enhancements: • Add the Spray Pond (including concrete liner, emergency spillway, riser encasements and earthen embankments) to its scope for inspection. • Include RG 1.127, Revision 1, Section C.2 inspection elements and degradation mechanisms for water-control structure inspection. • Include acceptance criteria as delineated in NUREG-1801 Section XI.S7 for water-control structures. Evaluation criteria provided in Chapter 5 of ACI 349.3R-96 provides acceptance criteria (including quantitative criteria) for determining the adequacy of observed aging effects and specifies criteria for further evaluation.	A.1.2.42	Prior to the period of extended operation.
36) Non-EQ Electrical Cables and Connections Visual Inspection Program	Program is new. The Non-EQ Electrical Cables and Connections Visual Inspection Program is credited with detecting aging effects from adverse localized environments in non-EQ cables and connections at SSES. The program is applicable to non-EQ cables and connections found in the Reactor Buildings, Circulating Water Pumphouse and Water Treatment Building, Control Structure, Diesel Generator Buildings, Turbine Building,	A.1.2.35	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
	Engineered Safeguards Service Water Pumphouse, and various yard structures (manholes, duct banks, valve vaults, instrument pits, etc.). This program is also applicable to the cables and connections within the scope of license renewal located in the yard areas and control cubicles of the T10 230 kV Switchyard, the 500 kV Switchyard, and the 230 kV Switchyard.		
37) Non-EQ Cables and Connections Used in Low-Current Instrumentation Circuits Program	Program is new. The Non-EQ Cables and Connections Used in Low-Current Instrumentation Circuits Program is credited with identifying aging effects for sensitive, high-voltage, low-current signal applications that are in-scope for license renewal at SSES. These sensitive circuits are potentially subject to reduction in insulation resistance (IR) when found in adverse localized environments.	A.1.2.34	Prior to the period of extended operation.
38) Non-EQ Inaccessible Medium-Voltage Cables Program	Program is new. The Non-EQ Inaccessible Medium-Voltage Cables Program involves two parts: first, the actions to inspect the applicable plant manholes (and to drain them, if necessary) on a periodic basis; and second, the development of a testing program to confirm that the conductor insulation on the applicable cables is not degrading. This program applies to six cables associated with the offsite power supply for SSES. These are the only inaccessible medium-voltage cables at SSES that are within the scope of license renewal and are exposed to significant moisture simultaneously with significant voltage.	A.1.2.36	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
39) Metal-Enclosed Bus Inspection Program	Program is new. The Metal-Enclosed Bus Inspection Program is credited with detecting aging effects for in-scope metal-enclosed bus at SSES. The applicable components for the metal-enclosed bus will be listed in the program implementing document(s), with their locations specified, as appropriate. The in-scope bus is limited to non-segregated metal-enclosed bus in the 13.8 kV and 4 kV electrical systems associated with the off-site power supply at SSES.	A.1.2.32	Prior to the period of extended operation.
40) Area-Based NSAS Inspection	Program is a new one-time inspection. The Area-Based NSAS Inspection includes confirming the environmental and/or internal surfaces conditions of subject nonsafety-related carbon steel (includes low alloy steel), cast iron, copper alloy and stainless steel components in systems that (frequently or continuously during normal plant operations) contain raw water, potable water, non-radioactive equipment/area drainage water, or in some select cases, treated water. The program is plant-specific.	A.1.2.1	Within the 10-year period prior to the period of extended operation.
41) Leak Chase Channel Monitoring Activities	The existing program is credited. The program is plant-specific.	A.1.2.27	Ongoing

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
42) Preventive Maintenance Activities – RCIC/HPCI Turbine Casings	Existing program is credited with the following enhancements: • Include a specific step to perform a visual inspection of the RCIC turbine casing. • Add requirements to have inspections performed by qualified personnel using VT-3 or equivalent inspection methods, and to document and trend inspection results. • Establish specific acceptance criteria for inspection results. The program is plant-specific.	A.1.2.39	Prior to the period of extended operation.
43) Fatigue Monitoring Program	Existing program is credited with the following enhancements: • Provisions will be made in the Fatigue Monitoring Program to validate that components which have satisfied ASME Section III, Paragraph N-415.1 requirements (i.e., RPV nozzles N6A, N6B, and N7) continue to satisfy these requirements prior to and during the period of extended operation, thereby allowing fatigue to be continued to be addressed under N-415.1. • The Fatigue Monitoring Program will be enhanced to ensure that the fatigue usage at all monitored locations, including those locations that account for the effect of the reactor water environment, is managed such that an adequate margin against fatigue cracking is maintained. PPL will implement one or more of the following actions, if fatigue usage at a monitored location, including any location that accounts for the effect of the reactor water environment, is projected to reach the	A.1.2.49	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
43) Fatigue Monitoring Program (cont'd)	design basis limit prior to the end of the period of extended operation: 1. Further refinement of the fatigue analyses to lower the CUFs to less than the allowable; 2. Repair of the affected components; 3. Replacement of the affected components; 4. Management by an inspection program that has been reviewed and approved by the NRC. • The Fatigue Monitoring Program will be enhanced to include the review of Class 1 valve fatigue analyses and other fatigue-related TLAA, such as flued head analyses and high energy line break evaluations, when sufficient fatigue accumulation has occurred, to determine if additional actions are required to address fatigue-related concerns. • The Fatigue Monitoring Program will be enhanced to include fatigue monitoring of the additional locations required to bound the limiting locations applicable to SSES, as identified in NUREG/CR-6260. • The Fatigue Monitoring Program will be enhanced to establish monitoring criteria to ensure that the fatigue usage at all monitored locations, including those locations that account for the effect of the reactor water environment, is managed such that design basis limits are not exceeded during the period of extended operation. The Fatigue Monitoring Program will define specific fatigue usage values for all monitored locations that, if reached, will require further action. These fatigue usage values shall be conservatively set to		

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
	values that will allow for not less than 4 years of additional plant operation before the actual fatigue usage at any location would reach the design basis limit. Upon reaching the defined usage at a location, the Fatigue Monitoring Program will require an action request to be generated. The action request will require further engineering evaluation to resolve the issue.		
44) Environmental Qualification (EQ) Program	Existing program is credited. For those EQ components that do not show a minimum 60-year life, the EQ Program will ensure qualified life is not exceeded by directing refurbishment, replacement, or reanalysis to extend the qualification.	A.1.3.4	Ongoing
45) Closed Cooling Water Chemistry Program	Existing program is credited.	A.1.2.13	Ongoing.
46) Fire Water System Program	Existing program is credited with the following enhancements: • The Fire Water System Program will be revised to incorporate sprinkler head sampling/replacements, in accordance with NFPA 25. • The Fire Water System Program will be revised to incorporate ultrasonic testing of representative above ground portions of water suppression piping that are exposed to water but which do not normally experience flow, are associated with a dry-pipe sprinkler system and may contain stagnant water, or is pre-action or deluge piping that is normally dry but may have been wetted and not completely dried.	A.1.2.19	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
	• Perform at least one visual inspection (opportunistic or focused) of the internal surface of buried fire water piping, within the 10 year period prior to the period of extended operation. • Perform at least one inspection per year of 'wet' fire protection piping for wall thickness and pipe blockage, if no opportunistic inspection has been completed.		
47) Fuel Oil Chemistry Program	Existing program is credited.	A.1.2.21	Ongoing
48) Lubricating Oil Analysis Program	Existing program is credited with the following enhancements: • The Lubricating Oil Analysis Program will be enhanced to include sampling of the lubricating oil from the Control Structure Chiller and Diesel Engine Driven Fire Pump when the oil is changed. The oil will be tested for water and for particle count. • The Lubricating Oil analysis Program will be revised to include sampling of the lubricating oil from the Reactor Building Chiller when the oil is changed. The oil will be tested for water and particle count.	A.1.2.28	Prior to the period of extended operation.
49) Lubricating Oil Inspection	Program is a new one-time inspection. The Lubricating Oil Inspection detects and characterizes the condition of materials in systems and components for which the Lubricating Oil Analysis Program is credited with aging management. The inspection provides	A.1.2.29	Within the 10-year period prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
	direct evidence as to whether, and to what extent, a loss of material or a reduction in heat transfer due to fouling has occurred.		
50) Non-EQ Electrical Cable Connections Program	Program is new. The non-EQ Electrical Cable Connections Program manages the aging for the metallic parts of non-EQ electrical cable connections within the scope of license renewal. The program addresses cable connections that are used to connect cable conductors to other cables or electrical devices. Aging management for the metallic parts of the non-EQ electrical cable connections that are subject to aging stressors will be provided by testing.	A.1.2.37	Prior to the period of extended operation.
51) New P-T Curves	Revised Pressure-Temperature (P-T) limits will be submitted to the NRC for approval when necessary to comply with 10 CFR 50 Appendix G.	A.1.3.1.4	Ongoing
52) OE Review at EPU Conditions	Perform an Operating Experience (OE) review for the period of operation at EPU conditions and its impact on aging management programs for systems, structures and components (SSCs).	---------	Prior to the period of extended operation.
53) Incorporate FSAR Supplement	Incorporate FSAR Supplement into the SSES FSAR as required by 10 CFR 54.21(d).	A.1.1	Following issuance of the renewed operating licenses.
54) Re-apply for relief request	PPL will process a relief request for circumferential vessel shell weld volumetric examinations for the period of extended operation.	A.1.3.1.5	Prior to the period of extended operation.

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
55) CorePlate Hold Down Bolts	PPL will either (1) obtain NRC approval of a SSES plant-specific evaluation consistent with BWRVIP-25 to demonstrate that the core plate rim hold-down bolts will be capable of preventing lateral displacement of the core plate for the period of extended operation (the plant-specific evaluation will be submitted for NRC review no less than 2 years prior to the period of extended operation and will address the inspection strategy for the hold-down bolts) or (2) install core plate wedges to structurally replace lateral load resistance provided by the bolts.	A.1.3.6.3	Prior to the period of extended operation.
56) BWRVIP-76	PPL will address any future conditions, requirements, or limitations imposed by the NRC's safety evaluation for license renewal for BWRVIP-76.	A.1.3.6.4	Prior to the period of extended operation.
57) Preventative Maintenance Activities-Main Turbine Casing	Existing program is credited with the following enhancement: • Specify that the inspection of the high-pressure turbine shell will consist of a visual inspection (VT-3 or equivalent) of accessible surfaces and an ultrasonic examination of selected locations for wall thickness. The program is plant-specific.	A.1.2.50	Prior to the period of extended operation.
58) Activities in Response to NRC Generic Letter 88-14	Activities credited in the SSES response to NRC Generic Letter 88-14 will be continued throughout the period of extended operation.	---------	Ongoing

Table A-1 SSES License Renewal Commitments			
Item Number	**Commitment**	**UFSAR Supplement Location (LRA App. A)**	**Enhancement or Implementation Schedule**
59) Fuse Holders Program	Program is new. The Fuse Holders Program is credited with identifying increased connection resistance between the fuse holder metallic clamp and fuse due to fatigue of the metallic clamp. The program provides for periodic inspection of fuse holder clamps within the scope of license renewal that are not in enclosures containing active components and whose fuses are scheduled for removal once every 12 months, or more frequently.	A.1.2.51	Prior to the period of extended operation.
60) Activities in Response to NRC Concerns Regarding Fatigue Analyses	PPL will either (1) implement fatigue monitoring software that satisfactorily addresses all issues raised in the proposed Regulatory Information Summary (RIS 2008-30), "Fatigue Analysis of Nuclear Power Plant Components,", or (2) perform a confirmatory ASME Code, Section III fatigue evaluation for the SBF-monitored locations to justify the existing FatiguePro methodology used at SSES Units 1 and 2.	----------	Prior to the period of extended operation.
61) Boral Coupon Testing	Spent fuel pool Boral coupon testing will be continued in the period of extended operation with one set of coupons being tested during the tenth or eleventh year after Unit 1 enters the period of extended operation. SSES FSAR section 9.1.2.3.3 Inservice Inspection will be revised to identify the coupon testing schedule during the period of extended operation. SSES FSAR section 9.1.2.3.3.2 Test Coupon Inspection will be revised to require neutron attenuation testing as part of the inspection of test coupons removed from the spent fuel pool.	----------	Revise the FSAR prior to the period of extended operation, with coupon testing ongoing as indicated.

Appendix B

APPENDIX B

CHRONOLOGY

This appendix lists chronologically the routine licensing correspondence between the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff) and PPL Susquehanna, LLC (PPL). This appendix also lists other correspondence on the staff's review of the Susquehanna Steam Electric Station (SSES), Units 1 and 2 license renewal application (LRA) (under Docket Nos. 50-387 and 50-388).

APPENDIX B: CHRONOLOGY	
Date	**Subject**
09/13/2006	Letter from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application ", (ML062620157)
09/20/2006	Press Release, NRC/OPA, "Press Release-06-115: NRC Announces Availability of License Renewal Application for Susquehanna Steam Electric Station, Units 1 and 2," (ML062630232)
09/26/2006	Federal Register Notice Letter, from Gillespie F P, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Receipt and Availability of the License Renewal Application for the Susquehanna Steam Electric Station.," ,(ML062690158)
10/11/2006	Letter Technical Specification, Bases Change Technical Specifications, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Proposed License Amendment Numbers 285 for Unit 1 And 253 for Unit 2, Constant Pressure Power Uprate," (ML062900160)
10/26/2006	Federal Register Notice Letter, from Gillespie F P, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from PPL Susquehanna, LLC., for renewal of the Operating Licenses for the Susquehanna Steam Electric Station," (ML062930293)
10/31/2006	Press Release, NRC/OPA, "Press Release-06-138: NRC Announces Opportunity to Request a Hearing on License Renewal Application for Susquehanna Nuclear Power Plant.," (ML063040604)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
11/02/2006	Federal Register Notice, Meeting Agenda Meeting Notice, from Mullins A, NRC/NRR/ADRO/DLR/REBB, to Franovich R L, NRC/NRR/ADRO/DLR/REBB, "11/15/2006 Notice of Forthcoming Meeting to Discuss the License Renewal Process and Environmental Scoping for Susquehanna Steam Electric Station, License Renewal Application Review" (ML062990010)
11/02/2006	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna, Units 1 and 2, Acceptability and Sufficiency for Docketing - Application for Renewed Operating Licenses Numbers NPF-14 and NPF-22.," (ML063130413)
11/06/2006	Press Release, NRC/OPA/RGN-I/FO, "Press Release-I-06-058: NRC To Discuss Process For Review of License Renewal Application For Susquehanna Nuclear Plant, Seeks Environmental Input " (ML063100410)
11/15/2006	Meeting Agenda, NRC/NRR, "Susquehanna Steam Electric Station 11/15/06 Environmental Scoping Meeting Agenda and Open House Welcome " (ML063240148)
11/15/2006	Slides and Viewgraphs, NRC/NRR, "Susquehanna Steam Electric Station 11/15/06 Environmental Scoping Meeting Slide Handouts " (ML063240150)
01/02/2007	Legal-Intervention Petition, Responses and Contentions, from Epstein E J, - No Known Affiliation, NRC/SECY/RAS, "2007/01/02-Susquehanna- Legal-Intervention Petition Re: PPL Susquehanna LLC Application for Susquehanna Steam Electric Station's Renewed Operating Licenses " (ML070170485)
01/10/2007	Legal-Intervention Petition, Responses and Contentions, from Epstein E J, - No Known Affiliation, NRC/SECY, "2007/01/10- Susquehanna-Email from Eric Epstein re: Service to Parties the supplemental filing relating to SAMA requirements " (ML070310330)
01/12/2007	Legal-Hearing Request Referral Memorandum, from Vietti-Cook A L, NRC/SECY, to Hawkens E R, NRC/ASLBP, "2007/01/12-Memorandum fo the Secretary referring the intervention petition of Eric Joseph Espstein submitted for intervention in the Susquehanna License Renewal proceeding to the ASLBP," , (ML070170135)
01/13/2007	Rulemaking-Comment, from Epstein E, Three Mile Island Alert, Inc., NRC/SECY/RAS, "2007/01/13-Comment (1) submitted by Three Mile Island Alert,I Inc., Eric Epstein on Massachusetts Attorney General's PRM-51-10 re to Amend 10 CFR Part 51 " (ML070180478)
01/23/2007	Legal-Order, from Young A M, NRC/ASLBP, "2007/01/23 -LB ORDER (Regarding Schedule and Guidance for Proceedings)," , (ML070230569)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
01/29/2007	Legal-Intervention Petition, Responses and Contentions, from Barkman M L Martin J C, NRC/OGC, NRC/ASLBP, "2007/01/29 - Susquehanna - NRC Staff Response to Eric Joseph Epstein's Petition for Leave to Intervene, Request for Hearing and Contentions " (ML070300052)
01/29/2007	Legal-Intervention Petition, Responses and Contentions, from Lewis D R, Pillsbury, Winthrop, Shaw, Pittman, LLP PPL Susquehanna, LLC, NRC/ASLBP, "2007/01/29 - Susquehanna - PPL Susquehanna's Answer to Eric Epstein's Petition for Leave to Intervene " (ML070360282)
01/31/2007	Legal-Report, from Epstein E J, Three Mile Island Alert, Inc, NRC/ASLBP, "2007/01/31 - Susquehanna - Notice of Related Filing by Three Mile Island Alert Incorporated, submitted by Eric Joseph Epstein " (ML070370621)
02/05/2007	Legal-Intervention Petition, Responses and Contentions, from Epstein E J, - No Known Affiliation, NRC/ASLBP, "2007/02/05 - Susquehanna - Eric Joseph Epstein's Response to PPL Susquehanna's Answer and Petitioners Response to NRC Staff's Response for leave to Intervene, Request for Hearing, and Contentions " (ML070510363)
02/05/2007	Legal-Motion, from Epstein E J, - No Known Affiliation, NRC/ASLBP, "2007/02/05- Susquehanna - Eric Joseph Epstein's Motion to Compel PPL Susquehanna, LLC to: (1) Apply for a Direct License Transfer (Or Incorporate Modifications from an NRC Approved Transfer Into the Relicensing Application)" (ML070470585)
02/13/2007	Legal-Motion, from Lewis D R, Pillsbury, Winthrop, Shaw, Pittman, LLP PPL Susquehanna, LLC, NRC/ASLBP, "2007/02/13- Susquehanna - PPL Susquehanna's Motion to Strike Portions of Eric Epstein's Response to Answers to Petition to Intervene " (ML070520456)
02/15/2007	Legal-Motion, from Martin J C, NRC/OGC, "2007/02/15 - Susquehanna - NRC Staff Response to Eric Joseph Epstein's Motion to Compel and Request for Schedular Exemption," , (ML070510031)
02/23/2007	Legal-Intervention Petition, Responses and Contentions, from Epstein E J, - No Known Affiliation, NRC/ASLBP, "2007/02/23- Susquehanna - Eric Joseph Epstein's Response to PPL Susquehanna's Motion to Strike Portions of Eric Epstein's Response to Answers to Petition to Intervene " (ML070610194)
02/28/2007	Legal-Order, from Young A, NRC/ASLBP, "2007/02/28-LB Order (Scheduling Telephone Conference)," (ML070590643)
03/02/2007	Inspection Plan Letter, from Gray M, NRC/RGN-I/DRP/PB4, to McKinney B T, PPL Susquehanna, LLC, "Annual Assessment Letter - Susquehanna Steam Electric Station (Report 05000387/2007001 and 05000388/2007001)," (ML070610580)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
03/20/2007	Letter Request for Additional Information (RAI), from Sanabria Y D, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application," (ML070720456)
03/20/2007	Legal-Intervention Petition, Responses and Contentions, from Epstein E J, - No Known Affiliation, NRC/ASLBP, "2007/03/20 - Susquehanna - Eric Joseph Epstein's Response to the NRC Staff's Motion to Strikes Portions of Eric Joseph Epstein Response to the Atomic Safety Licensing Board Panel's Request for Information." (ML070930609)
03/22/2007	Legal-Memorandum and Order, from Lathrop H K Sager W, Young A, NRC/ASLBP, "2007/03/22-LB Memorandum and Order (Ruling on Standing and Contentions of Petitioner Eric Joseph Epstein) (LBP-07-04)," (ML070820022)
04/17/2007	Press Release, NRC/OPA/RGN-I/FO, "Press Release-I-07-020: NRC To Discuss 2006 Assessment For Susquehanna Nuclear Plant At Public Meeting Scheduled For April 24.," (ML071070494)
04/17/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station - Application for Renewed Operating Licenses in Response to Scoping and Screening RAI's.," (ML071140385)
04/27/2007	Letter Schedule and Calendars, from Diaz-Sanabria Y K, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Revision of Schedule for the Conduct of the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application," (ML071000062)
05/11/2007	Legal-Intervention Petition, Responses and Contentions, from Epstein E J, - No Known Affiliation, NRC/SECY/RAS, "Petition to Intervene with Respect to the Proposed Amendment Request for a Thermal Power Increase for the Susquehanna Steam Electric Station, Units 1 and 2," , (ML071430580)
05/16/2007	Letter Request for Additional Information (RAI), from Sanabria Y K, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Requests for Additional Information (RAI 4.1.3) for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML071270018)
06/12/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station, Application for Renewed Operating Licenses Numbers NPF-14 and NPF-22, Requests for Additional Information (RAI 4.1.3) " (ML071760100)

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06/15/2007	Meeting Summary Note to File, Telcon Record, Verbal Comm Request for Additional Information (RAI), from Diaz-Sanabria Y, NRC/NRR/ADRO/DLR/RLRA, PPL Susquehanna, LLC, "Summary of Telephone Conference Call Held on May 29, 2007, Between the U.S. Nuclear Regulatory Commission and PPL Susquehanna, LLC, Concerning Requests for Additional Information Pertaining to the Susquehanna Steam Electric Station, Units 1 and 2, LRA " (ML071510549)
06/15/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station, Application for Renewed Operating Licenses, Responses to Environmental Audit Questions " (ML071790414)
06/22/2007	Letter Request for Additional Information (RAI), from Diaz-Sanabria Y K, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Requests for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML071710542)
06/28/2007	Memoranda Safety Evaluation Report, from Auluck R C, NRC/NRR/ADRO/DLR/RLRB, to Lund A L, NRC/NRR/ADRO/DLR/RLRA, "Scoping and Screening Draft Safety Evaluation Report Input Regarding the PPL Susquehanna, LLC, Application for the Susquehanna Steam Electric Station, Units 1 and 2 Dated September 13, 2006 " (ML071790336)
07/12/2007	Letter, from Lund A L, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Project Manager Change for the License Renewal Environmental Review for Susquehanna Steam Electric Station, Units 1 and 2, (TAC Nos. MD3021 and MD3022) " (ML071920034)
07/24/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Response to Request for Additional Information in Regard to Application for Renewed Operating Licenses NPF-14 and NPF-22 " (ML072200268)
07/25/2007	Letter, from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Revision of Schedule for the Conduct of Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application," , (ML071920267)
07/25/2007	Letter Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Requests for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application (RAI 2.2-1 - 2.3.2.6-5) " (ML071970085)

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07/30/2007	Letter Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application (RAI 2.5-1 to RAI 2.5-2)," , (ML071970114)
08/03/2007	Letter Request for Additional Information (RAI), from Gettys E, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Requests for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application RAI section 2.4 " (ML072120507)
08/23/2007	Letter, Request for Additional Information (RAI), from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station, Units 1 and 2, Response to NRC Requests for Additional Information for Review of License Renewal Application (LRA) Sections 2.2 & 2.3 " (ML072480272)
08/23/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 & 2 - Request for Additional Information (RAI) for the Review of the License Renewal Application (LRA) Section 2.5 PLA-6261 " (ML072540680)
08/27/2007	Letter, Meeting Summary, from Gettys E, NRC/NRR/ADRO/DLR/RLRA, "Summary of Telephone Conference Call Held on July 26, 2007, Between the U.S. Nuclear Regulatory Commission and PPL Susquehanna, LLC, Concerning Draft Requests for Additional Information Pertaining to the Susquehanna Steam Electric Station, Units 1 and 2 " (ML072330167)
08/27/2007	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Requests for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML072330234)
08/27/2007	Memoranda, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, PPL Susquehanna, LLC, "Summary of Telephone Conference Call Held on August 16, 2007, Between the US NRC and PPL Susquehanna, Concerning Request for Additional Information Pertaining to the Susquehanna, Units 1 and 2, License Renewal Application " (ML072330414)
08/28/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Requests for Additional Information for the Review of the Susquehanna Steam Electric Station Units 1 & 2, License Renewal Application (LRA) Section 2.4 " (ML072490210)

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09/05/2007	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Requests for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML072360229)
09/07/2007	Letter, Meeting Summary, from Gettys E, NRC/NRR/ADRO/DLR/RLRA, PPL Susquehanna, LLC, "Summary of Telephone Conference Call Held on August 23, 2007, Between the U.S. Nuclear Regulatory Commission and PPL Susquehanna, LLC, Concerning Draft Requests for Additional Information Pertaining to the Susquehanna Steam Electric Station, Units 1 & 2 " (ML072360232)
09/12/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Annual Amendment to the Application for Renewed Operating License Numbers NPF-14 and NPF-22 Pursuant to 10 CFR 54.21(b) " (ML072640347)
09/17/2007	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Requests for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML072490602)
09/18/2007	Meeting Summary, Request for Additional Information (RAI), from Gettys E, NRC/NRR/ADRO/DLR/RLRA, PPL Susquehanna, LLC, "08/28/2007 and 09/05/2007 Summary of Telephone Conference Calls Between the U.S. Nuclear Regulatory Commission and PPL Susquehanna, LLC, Concerning D-RAI " (ML072490046)
09/18/2007	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application RAI 4.7.1 " (ML072490110)
09/20/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station Units 1 & 2, Follow-up to Request for Additional Information for the Review of the License Renewal Application (LRA) Section 4.1.3 " (ML072750526)
10/16/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2 - Request for Additional Information (RAI) for the Review of the License Renewal Application (LRA) Section 4.7.1 PLA-6289 " (ML073030455)

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10/16/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Units 1 & 2 Request for Additional Information (RAI) for the Review of the License Renewal Application (LRA) Section B.2.21 " (ML073030487)
10/18/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Response to Request for Additional Information Regarding Review of License Application (LRA) Sections 4.2.3, 4.2.4, 4.2.5, 4.2.7 and 4.7.3 " (ML073040282)
10/18/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Request for Additional Information (RAI) for the Review of the Susquehanna Steam Electric Station Units 1 and 2, License Renewal Application (LRA) Sections 2.2, 2.3.3, 2.3.4 " (ML073120069)
10/24/2007	Meeting Summary, Note to File Telcon Record, Verbal Comm Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, Susquehanna Steam Electric Co, "09/12/2007 Summary of Telephone Conference Call with PPL Susquehanna, LLC Concerning Requests for Additional Information " (ML072640134)
10/24/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station, Requests for Additional Information - License Renewal Application (LRA) Section 2.3.3.13 RAI Follow-Up, PLA-6296 " (ML073120062)
10/24/2007	Meeting Summary Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, PPL Susquehanna, LLC, "09/26/2007 Summary of Telephone Conference Call Between the NRC and PPL Susquehanna, LLC Concerning Requests for Additional Information Pertaining to the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML072760276)
10/24/2007	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Requests for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML072850255)
11/14/2007	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, "Susquehanna Steam Electric Station, Requests for Additional Information - License Renewal Application (LRA) Section 2.3.1,", (ML073370551)

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11/16/2007	Memoranda, Note to File, Telcon Record, Verbal Comm Request for Additional Information (RAI), from Gettys E H, PPL Susquehanna, LLC, "Summary of Telephone Conference Call Held on October 3, 2007, Between the U.S. Nuclear Regulatory Commission and PPL Susquehanna, LLC Concerning Open Items Pertaining to the Susquehanna, Units 1 and 2, License Renewal Application " (ML072851110)
12/13/2007	Memoranda Note to File, Telcon Record, Verbal Comm Request for Additional Information (RAI), from Gettys E, NRC/NRR/ADRO/DLR/RLRA, PPL Susquehanna, LLC, "Summary of Telephone Conference Call Held on 10/03/07, Between the U.S. Nuclear Regulatory Commission and PPL Susquehanna, LLC, Concerning Fire," , (ML072880051)
12/17/2007	Final Safety Analysis Report (FSAR) Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 & 2 - License Renewal Application, Request for Additional Information, Revised FSAR Supplement Section A.1.3.1.7, PLA-6313 " (ML073620332)
01/03/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Submittal of Supplemental Information Related to RAI 2.3.3.27-4 " (ML080140264)
01/22/2008	Letter, from Gettys E, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Revision of Schedule for the Conduct of Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML080110291)
02/11/2008	Meeting Summary, from Gettys E, NRC/NRR/ADRO/DLR, to McKinney B T, Susquehanna Steam Electric Co, "Summary of Telephone Conference Call Held on December 28, 2007, Between the U.S. Nuclear Regulatory Commission and PPL Susquehanna, LLC, Concerning Requests for Additional Information Pertaining to the Susquehanna Steam Electric Station, Units 1 and 2 " (ML080140515)
05/01/2008	Letter from NRC to PPL Susquehanna, LLC Revision of Schedule for the Conduct of Review of the Susquehanna Steam Electric Station, Units 1 and 2 License Renewal Application, (ML080580119)
05/07/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, to NRC/Document Control "Susquehanna Steam Electric Station, Request for Additional Information for the Review of License Renewal Application Station Blackout Scope Addition," (ML081420028)
05/30/2008	Letter, Request for Additional Information (RAI), from Gettys E H, to McKinney B T, PPL Susquehanna, LLC, "Susquehanna Steam Electric Station, Units 1 and 2, Request for Additional Information, Review of License Renewal Application.," (MI081480435)

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06/09/2008	Letter, License-Application for Facility Operating License (Amend/Renewal) DKT 50, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Units 1 & 2, License Renewal Application, Amendment to Section 4.2.2 " (ML081710132)
06/10/2008	Letter, Request for Additional Information (RAI), from Gettys E H, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Unit 1 and 2, LRA., Generic RAI,",(MI081540571)
06/12/2008	Letter, Request for Additional Information (RAI), from Gettys E H, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Unit 1 and 2, LRA " (MI081550670)
06/13/2008	Letter, Request for Additional Information (RAI), from Gettys E H, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Unit 1 and 2, LRA " (ML081540668)
06/13/2008	Letter, Request for Additional Information (RAI), from Gettys E H, to McKinney B T, PPL Susquehanna, LLC, "Susquehanna Steam Electric Station, Units 1 and 2, Request for Additional Information, Review of License Renewal Application " (ML081410172)
06/17/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Susquehanna Steam Electric Station, Units 1 and 2, Request for Additional Information, License Renewal Application " (ML081550515)
06/23/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Susquehanna, Units 1 and 2, Request for Additional Information, Review of License Renewal Application " (ML081650217)
06/23/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML081540622)
06/30/2008	Letter, Request for Additional Information (RAI), from Gettys E H, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML081780094)
06/30/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, to NRC/Document Control "Susquehanna Steam Electric Station, Request for Additional Information for the Review of License Renewal Application, Sections B.2.11, B.2.13, B.2.16 and B.2.17 (ML081980121)

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07/03/2008	Letter, Request for Additional Information (RAI), from Gettys E H, to McKinney B T, PPL Susquehanna, LLC, "Susquehanna, Units 1 and 2, Request for Additional Information, Review of License Renewal Application " (ML081780698)
07/03/2008	Letter, Request for Additional Information (RAI), from Gettys E H, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal RAI " (ML081790066)
07/08/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, to NRC/Document Control "Susquehanna Steam Electric Station, Request for Additional Information for the Review of License Renewal Application Appendix B, PLA-6378 " (ML082040588)
07/08/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 & 2, Response for Additional Information for Review of License Renewal Application (LRA) Sections B.2.39, 3.5, & 4.6 " (ML082040626)
07/09/2008	Letter Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 & 2, License Renewal Application " (ML081890503)
07/10/2008	Letter Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Susquehanna, Units 1 & 2, Request for Additional Information, Review of License Renewal Application " (ML081890576)
07/14/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Units 1 & 2, Response to Request for Additional Information for the Review of the Units 1 & 2, License Renewal Application (LRA) Sections B.2.1, B.2.5, B.2.7, B.2.9, and B.2.10 " (ML082110399)
07/14/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 & 2, Response to Request for Additional Information for the Review of License Renewal Application Sections B.2.18 and B.2.30 " (ML082110400)
07/15/2008	Letter, Request for Additional Information (RAI), from Gettys E, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Electric Station, Units 1 and 2, License Renewal Application " (ML081920575)

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07/17/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Response to Request for Additional Information for the Review of License Renewal Application (LRA) Sections B.2.2, B.2.20, and B.2.22 " (ML082120075)
07/23/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML081960683)
07/23/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML081970397)
07/23/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML081990316)
07/24/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Response to Request for Additional Information for the Review of License Renewal Application Sections B.2.19 and 3.3.2.2.6 " (ML082190558)
07/25/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Response to Request for Additional Information for the Review of License Renewal Application (LRA), Sections B.2.23, B.2.24, B.2.26, B.2.27, B.2.28, B.2.31 " (ML082200292)
07/28/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Response to Request for Additional Information for the Review of the License Renewal Application Sections B.2.12 and B.2.15 " (ML082190557)
07/30/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR/RLRA, to McKinney B T, PPL Susquehanna, LLC, "Request for Additional Information for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, License Renewal Application " (ML082100599)

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08/01/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station - Request for Additional Information for the Review of Units 1 and 2, License Renewal Application (LRA) Sections B.3.1, 4.3, and 4.7 " (ML082250450)
08/05/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Request for Additional Information for the Review of the License Renewal Application (LRA) Sections B.2.41, B.2.42, B.2.43, B.3.2, and 3.6 " (ML082270204)
08/08/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna, Units 1 and 2, Response to Request for Additional Information for the Review of the License Renewal Application (LRA) Sections B.2.48, 3.0.3, 3.3.1 and 3.3.2 " (ML082400092)
08/12/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station, Request for Additional Information for the Review of the Susquehanna Steam Electric Station Units 1 and 2, License Renewal Application (LRA) Sections B.2.14, B.2.25, B.2.32, and B.2.33, PLA-6400 " (ML082330526)
08/13/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, to McKinney B T, PPL Susquehanna, LLC, "Susquehanna, Units 1 & 2, Request for Additional Information, Review of the License Renewal Application " (ML082250477)
08/15/2008	Meeting Summary, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/ADRO/DLR, "07/25/2008 Summary of Telephone Conference Call Between NRC and PPL Susquehanna, LLC, Concerning Draft Request for Additional Information Pertaining to the Susquehanna , Units 1 & 2 License Renewal Application " (ML082210375)
08/15/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna, Units 1 & 2, Response to Request for Additional Information for the Review of License Renewal Application (LRA) Sections 3.1, 3.2, 3.3, and 3.4 " (ML082400534)
08/22/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna, Units 1 and 2, Response to Request for Additional Information for the Review of the License Renewal Application, Sections B.2.13, B.2.17, 3.x, 3.2.2, 3.3.2, and 3.5.2 " (ML082480042)
08/22/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna, Units 1 and 2 - Request for Additional Information for the Review of License Renewal Application (LRA) Sections 3.3, B.2.6 and B.2.49.," (ML082480043)

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08/22/2008	Meeting Summary, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/DLR/RPB1, PPL Susquehanna, LLC, "08/07/08, Summary of Telephone Conference Call Held Between the NRC and PPL Susquehanna, LLC., Concerning Draft's Pertaining to the Susquehanna Steam Electric Station, Units 1 & 2, License Renewal Application.,", (ML082260181)
08/27/08	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, Susquehanna, Units 1 & 2, Response to Request for Additional Information for the Review of the License Renewal Application (LRA) Sections B.2.8, B.2.9, 3.1.2, 3.2.2, 3.3.2, & 3.4.2 (ML082480294)
08/29/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna, Units 1 & 2, Response to Request for Additional Information for the Review of the License Renewal Application (LRA) Section 2.5.," (ML082610435)
09/11/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna Steam Electric Station, Units 1 & 2 - Request for Additional Information for the Review of License Renewal Application Supplemental Response to RAI's B.2.31-5 and B.2.31-6, PLA-6419.," (ML082670889)
09/23/2008	Letter, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/DLR/RPB1, to McKinney B T, PPL Susquehanna, LLC, "RAI for the Review of the Susquehanna Steam Electric Station, Units 1 and 2, LRA RAI on Sun (1).," (ML082530102)
09/23/2008	Letter, License-Application for Facility Operating License (Amend/Renewal) DKT 50, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Steam Electric Station, Units 1 & 2 - License Renewal Application (LRA) Amendments to Sections B.2.38, B.2.39, and B.2.47 in Response to NRC Regional Inspection PLA-6427.," (ML083030165)
09/26/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna, Units 1 and 2, License Renewal Application (LRA) Amendments to LRA and RAI Responses.," (ML082950012)
09/26/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna, Units 1 & 2 - Second Annual Amendment to the Application for Renewed Operating License Numbers NPF-14 and NPF-22 Pursuant to 10 CFR 54.21(b), PLA-6429.," (ML082950013)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
09/30/2008	Letter, License-Application for Facility Operating License (Amend/Renewal) DKT 50, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk NRC/NRR, "Susquehanna Units 1 & 2 - Licensee Renewal Application Amendments to Sections 2.1.1, B.2.14, B.2.22, B.2.28, B.2.28, B.2.31, and B.2.46 in Response to NRC Regional Inspection PLA-6428.," (ML082950011)
10/01/2008	Meeting Summary, Memoranda, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/DLR/RPB1, PPL Susquehanna, LLC, "06/25/2008 Meeting Summary, Telephone Conference Call Between the NRC and PPL Susquehanna, LLC, Concerning Draft Request for Additional Information Pertaining to the Susquehanna, Units 1 and 2, License Renewal Application.," (ML082260353)
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10/17/2008	Meeting Summary, Request for Additional Information (RAI), from Gettys E H, NRC/NRR/DLR/RPB1, PPL Susquehanna, LLC, "09/15/2008-Summary of Telephone Conference Call Between US NRC and PPL Susquehanna, LLC, Concerning Draft Request for Additional Information Pertaining to the Susquehanna Steam Electric Station, Units 1 & 2, License Renewal Application.," (ML082800439)
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APPENDIX B: CHRONOLOGY	
Date	**Subject**
10/22/2008	Letter, from McKinney B T, PPL Susquehanna, LLC, NRC/Document Control Desk, NRC/NRR, "Susquehanna, Units 1 and 2 - Response to Request for Additional Information for the Review of License Renewal Application Section B.2.12.," (ML083190019)
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11/03/2008	Meeting Summary, from Gettys E, NRC/NRR/DLR/RPB1, PPL Susquehanna, LLC, "Summary of Telephone Conference Call Held on Sept. 24, 2008, Between the U.S. NRC and PPL Susquehanna, LLC., Concerning Draft Requests for Additional Information Pertaining to the SSES, Units 1 and 2, License Renewal Application.," (ML083030591)
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Date	**Subject**
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Date	**Subject**
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6/01/2009	Meeting Summary Memoranda, from Gettys E H, NRC/NRR/DLR/RPB1, to PPL Susquehanna, LLC, "5/21/2009 Meeting Summary, Telephone Conference Call Between U.S. NRC and PPL Susquehanna, LLC, Concerning The Draft Request For Additional Information Pertaining To The Susquehanna Steam Electric Station Units 1 & 2, LRA," (MI091480082)
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Appendix C

APPENDIX C

PRINCIPAL CONTRIBUTORS

This appendix lists the principal contributors for the development of this safety evaluation report (SER) and their areas of responsibility.

Appendix C: Principal Contributors	
Name	**Responsibility**
R. Auluck	Management Oversight
H. Ashar	Structural Engineering
G. Cranston	Management Oversight
J. Davis	GALL Report Audit
R. Dennig	Management Oversight
Y.Diaz-Sanabria	Project Management
J. Dozier	Management Oversight
J. Fair	Mechanical Engineering
G. Galletti	Scoping and Screening Methodology Audit
Q. Gan	SER Support
E. Gettys	Project Management
K. Green	Scoping and Screening Methodology Audit
B. Holian	Management Oversight
A. Hiser	Management Oversight
D. Hoang	GALL Report Audit
D. Harrison	Management Oversight
N. Iqbal	Fire Protection
D. Jackson	Mechanical Engineering
W. Jackson	ATL
A. Johnson	Mechanical Engineering
A. Klein	Management Oversight
L. Lund	Management Oversight
K. Manoly	Management Oversight
J. Medoff	GALL Report Audit
G. Meyer	Regional 1 Inspection
M. Mitchell	Management Oversight
D. Nguyen	GALL Report Audit
E. Patel	ATL
D. Pelton	Management Oversight
J. Raval	Ventilation System
S. Ray	Electrical Engineering
D. Reddy	Scoping and Screening Methodology Audit
B. Rogers	Scoping and Screening Methodology Audit
A. Sallman	Ventilation System
S. Sheng	Vessels & Internals Integrity
E. Smith	Plant Systems
G. Thomas	Structural Engineering
R. Sun	GALL Report Audit
G. Wilson	Management Oversight
E.Wong	Chemical Engineer
Z. Xi	GALL Report Audit
C.Yang	Mechanical Engineering
O. Yee	GALL Report Audit

Appendix C: Principal Contributors	
Name	**Responsibility**
Contractors	
Advanced Technologies and Laboratories International, Inc.	GALL Audit and Report
Pacific Northwest National Laboratory	Plant Systems

Appendix D

APPENDIX D

REFERENCES

This appendix lists the references used throughout this safety evaluation report (SER) for review of the license renewal application (LRA) for Susquehanna Steam Electric Station, Units 1 and 2.

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34.	Generic Letter (GL) 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," January 25, 1988.
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NRC FORM 335
(9-2004)
NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER
(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG-1931

2. TITLE AND SUBTITLE

Safety Evaluation Report Related to the License Renewal of Susquehanna Steam Electric Station, Units 1 and 2

3. DATE REPORT PUBLISHED

MONTH	YEAR
November	2009

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

Evelyn Gettys

6. TYPE OF REPORT

7. PERIOD COVERED *(Inclusive Dates)*

Sept. 13, 2006 - Nov. 25, 2009

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Same as above

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This safety evaluation report (SER documents the technical review of the Susquehanna Steam Electric Station (SSES), Units 1 and 2 license renewal application (LRA) by the United States (US) Nuclear Regulatory Commission (NRC) staff. By letter dated September 13, 2006, PPL Susquehanna, LLC (PPL) submitted the LRA in accordance with Title 10, Part 54, of the Code of Federal Regulations, "Requirements for Renewal of Operating Licenses of Nuclear Power Plants." PPL requests renewal of the Units 1 and 2, (Facility Operating License Numbers DPR-14 and NPR-22 respectively) for a period of 20 years beyond the current license which expires at midnight July 17, 2022, for Unit 1 and at midnight March 23, 2024, for Unit 2.

SSES is located approximately 5 miles northeast of Berwick, Pennsylvania. The NRC issued the construction permits for Unit 1 and 2 on November 2, 1973. The NRC issued the operating licenses for Unit 1 on July 17, 1982, and on March 23, 1984, for Unit 2. General Electric supplied the nuclear steam supply system and Bechtel originally designed and constructed the balance of the plant. The licensed power output of each unit is 3952 megawatt thermal with a gross electrical output of approximately 1300 megawatt electric.

The SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the units' proposed operation for an additional 20 years beyond the term of the current operating licenses.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

10 CFR Part 54, license renewal, SSES, Susquehanna Steam Electric Station, scoping and screening, aging management, time-limited aging analysis, safety evaluation report

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)

unclassified

(This Report)

unclassified

15. NUMBER OF PAGES

16. PRICE

PRINTED ON RECYCLED PAPER



Federal Recycling Program



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

OFFICIAL BUSINESS