SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This section of the safety evaluation report (SER) evaluates aging management programs (AMPs) and aging management reviews (AMRs) for Shearon Harris Nuclear Power Plant (HNP) Unit 1 by the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff). In Appendix B of its license renewal application (LRA), Carolina Power & Light Company (CP&L or the applicant) described the 39 AMPs that it relies on to manage or monitor the aging of passive, long-lived structures and components (SCs).

In LRA Section 3, the applicant provided the results of the AMRs for those SCs identified in LRA Section 2 as within the scope of license renewal and subject to an AMR.

3.0 Applicant's Use of the Generic Aging Lessons Learned Report

In preparing its LRA, the applicant credited NUREG-1801, Revision 1, "Generic Aging Lessons Learned (GALL) Report," dated September 2005. The GALL Report contains the staff's generic evaluation of the existing plant programs and documents the technical basis for determining where existing programs are adequate without modification and where existing programs should be augmented for the period of extended operation. The evaluation results documented in the GALL Report indicate that many of the existing programs are adequate to manage the aging effects for particular license renewal SCs. The GALL Report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. An applicant may reference the GALL Report in its LRA to demonstrate that its programs correspond to those reviewed and approved in the report.

The purpose of the GALL Report is to provide a summary of staff-approved AMPs to manage or monitor the aging of SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources for LRA review will be greatly reduced, improving the efficiency and effectiveness of the license renewal review process. The GALL Report also serves as a quick reference for applicants and staff reviewers to AMPs and activities that the staff has determined will adequately manage or monitor aging during the period of extended operation.

The GALL Report identifies: (1) systems, structures, and components (SSCs), (2) SC materials, (3) environments to which the SCs are exposed, (4) the aging effects of the materials and environments, (5) the AMPs credited with managing or monitoring the aging effects, and (6) recommendations for further applicant evaluations of aging management for certain component types.

To determine whether use of the GALL Report would improve the efficiency of LRA review, the staff conducted a demonstration of the GALL Report process in order to model the format and content of safety evaluations based on it. The results of the demonstration project confirmed that the GALL Report process will improve the efficiency and effectiveness of LRA review while maintaining the staff's focus on public health and safety. NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated September 2005, was prepared based on both the GALL Report model and lessons learned from the demonstration project.

The staff 's review was in accordance with Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and the guidance of the SRP-LR and the GALL Report.

In addition to its review of the LRA, the staff conducted an onsite audit of selected AMRs and associated AMPs during the weeks of April 23-27, May 21-25 and June 25-29, 2007. The onsite audits and reviews are designed for maximum efficiency of the staff's LRA review. The applicant can respond to questions, the staff can readily evaluate the applicant's responses, the need for formal correspondence between the staff and the applicant is reduced, and the result is an improvement in review efficiency.

3.0.1 Format of the License Renewal Application

The applicant submitted an application that follows the standard LRA format agreed to by the staff and the Nuclear Energy Institute (NEI) by letter dated April 7, 2003. This revised LRA format incorporates lessons learned from the staff's reviews of the previous five LRAs, which used a format developed from information gained during a staff-NEI demonstration project conducted to evaluate the use of the GALL Report in the LRA review process.

The organization of LRA Section 3 parallels that of SRP-LR Chapter 3. LRA Section 3 presents AMR results information in the following two table types:

(1) Table 1s: Table 3.x.1 – where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, and "1" indicates that this table type is the first in LRA Section 3.
(2) Table 2s: Table 3.x.2-y – where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, "2" indicates that this table type is the second in LRA Section 3, and "y" indicates the system table number.

The content of the previous LRAs and of the HNP application is essentially the same. The intent of the revised format of the LRA was to modify the tables in LRA Section 3 to provide additional information that would assist in the staff's review. In its Table 1s, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In its Table 2s, the applicant identified the linkage between the scoping and screening results in LRA Section 2 and the AMRs in LRA Section 3.

3.0.1.1 Overview of Table 1s

Each Table 1 compares in summary how the facility aligns with the corresponding tables in the GALL Report. The tables are essentially the same as Tables 1 through 6 in the GALL Report, except that the "Type" column has been replaced by an "Item Number" column and the "Item

Number in GALL" column has been replaced by a "Discussion" column. The "Item Number" column is a means for the staff reviewer to cross-reference Table 2s with Table 1s. In the "Discussion" column the applicant provided clarifying information. The following are examples of information that might be contained within this column:

- further evaluation recommended - information or reference to where that information is located
- The name of a plant-specific program
- exceptions to GALL Report assumptions
- discussion of how the line is consistent with the corresponding line item in the GALL Report when the consistency may not be obvious
- discussion of how the item is different from the corresponding line item in the GALL Report (*e.g.*, when an exception is taken to a GALL Report AMP)

The format of each Table 1 allows the staff to align a specific row in the table with the corresponding GALL Report table row so that the consistency can be checked easily.

3.0.1.2 Overview of Table 2s

Each Table 2 provides the detailed results of the AMRs for components identified in LRA Section 2 as subject to an AMR. The LRA has a Table 2 for each of the systems or structures within a specific system grouping (*e.g.*, reactor coolant system, engineered safety features, auxiliary systems, etc.). For example, the engineered safety features group has tables specific to the containment spray system, containment isolation system, and emergency core cooling system. Each Table 2 consists of nine columns:

- Component Type – The first column lists LRA Section 2 component types subject to an AMR in alphabetical order.
- Intended Function – The second column identifies the license renewal intended functions for the listed component types. Definitions of intended functions are in LRA Table 2.0-1.
- Material – The third column lists the particular construction material(s) for the component type.
- Environment – The fourth column lists the environments to which the component types are exposed. Internal and external service environments are indicated with a list of these environments in LRA Table 3.0-1.
- Aging Effect Requiring Management – The fifth column lists aging effects requiring management (AERMs). As part of the AMR process, the applicant determined any AERMs for each combination of material and environment.
- Aging Management Programs – The sixth column lists the AMPs that the applicant uses to manage the identified aging effects.
- NUREG-1801 Volume 2 Item – The seventh column lists the GALL Report item(s) identified in the LRA as similar to the AMR results. The applicant compared each combination of component type, material, environment, AERM, and AMP in LRA Table 2 with the GALL Report items. If there are no corresponding items in the GALL Report,

the applicant leaves the column blank in order to identify the AMR results in the LRA tables corresponding to the items in the GALL Report tables.

- Table 1 Item – The eighth column lists the corresponding summary item number from LRA Table 1. If the applicant identifies in each LRA Table 2 AMR results consistent with the GALL Report, the Table 1 line item summary number should be listed in LRA Table 2. If there is no corresponding item in the GALL Report, column eight is left blank. In this manner, the information from the two tables can be correlated.
- Notes – The ninth column lists the corresponding notes used to identify how the information in each Table 2 aligns with the information in the GALL Report. The notes, identified by letters, were developed by an NEI work group and will be used in future LRAs. Any plant-specific notes identified by numbers provide additional information about the consistency of the line item with the GALL Report.

3.0.2 Staff's Review Process

The staff conducted three types of evaluations of the AMRs and AMPs:

(1) For items that the applicant stated were consistent with the GALL Report, the staff conducted either an audit or a technical review to determine consistency.

(2) For items that the applicant stated were consistent with the GALL Report with exceptions, enhancements, or both, the staff conducted either an audit or a technical review of the item to determine consistency. In addition, the staff conducted either an audit or a technical review of the applicant's technical justifications for the exceptions or the adequacy of the enhancements.

The SRP-LR states that an applicant may take one or more exceptions to specific GALL AMP elements; however, any deviation from or exception to the GALL AMP should be described and justified. Therefore, the staff considers exceptions as being portions of the GALL AMP that the applicant does not intend to implement.

In some cases, an applicant may choose an existing plant program that does not meet all the program elements defined in the GALL AMP. However, the applicant may make a commitment to augment the existing program to satisfy the GALL AMP prior to the period of extended operation. Therefore, the staff considers these augmentations or additions to be enhancements. Enhancements include, but are not limited to, activities needed to ensure consistency with the GALL Report recommendations. Enhancements may expand, but not reduce, the scope of an AMP.

(3) For other items, the staff conducted a technical review to verify conformance with 10 CFR 54.21(a)(3) requirements.

Staff audits and technical reviews of the applicant's AMPs and AMRs determine whether the aging effects on SCs can be adequately managed to maintain their intended function(s) consistent with the plant's current licensing basis (CLB) for the period of extended operation, as required by 10 CFR Part 54.

3.0.2.1 Review of AMPs

For AMPs for which the applicant claimed consistency with the GALL AMPs, the staff conducted either an audit or a technical review to verify the claim. For each AMP with one or more deviations, the staff evaluated each deviation to determine whether the deviation was acceptable and whether the modified AMP would adequately manage the aging effect(s) for which it was credited. For AMPs not evaluated in the GALL Report, the staff performed a full review to determine their adequacy. The staff evaluated the AMPs against the following 10 program elements defined in SRP-LR Appendix A.

(1) Scope of the Program – Scope of the program should include the specific SCs subject to an AMR for license renewal.
(2) Preventive Actions – Preventive actions should prevent or mitigate aging degradation.
(3) Parameters Monitored or Inspected – Parameters monitored or inspected should be linked to the degradation of the particular structure or component intended function(s).
(4) Detection of Aging Effects – Detection of aging effects should occur before there is a loss of structure or component intended function(s). This includes aspects such as method or technique (*i.e.*, visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new/one-time inspections to ensure timely detection of aging effects.
(5) Monitoring and Trending – Monitoring and trending should provide predictability of the extent of degradation as well as timely corrective or mitigative actions.
(6) Acceptance Criteria – Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the structure or component intended function(s) are maintained under all CLB design conditions during the period of extended operation.
(7) Corrective Actions – Corrective actions, including root cause determination and prevention of recurrence, should be timely.
(8) Confirmation Process – Confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.
(9) Administrative Controls – Administrative controls should provide for a formal review and approval process.
(10) Operating Experience – Operating experience of the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended function(s) will be maintained during the period of extended operation.

Details of the staff's audit evaluation of program elements (1) through (6) are documented in SER Section 3.0.3.

The staff reviewed the applicant's quality assurance (QA) program and documented its evaluations in SER Section 3.0.4. The staff's evaluation of the QA program included assessment of the "corrective actions," "confirmation process," and "administrative controls" program elements.

The staff reviewed the information on the "operating experience" program element and documented its evaluation in SER Section 3.0.3.

3.0.2.2 Review of AMR Results

Each LRA Table 2 contains information concerning whether or not the AMRs identified by the applicant align with the GALL Report AMRs. For a given AMR in a Table 2, the staff reviewed the intended function, material, environment, AERM, and AMP combination for a particular system component type. Item numbers in column seven of the LRA, "NUREG-1801 Volume 2 Item," correlate to an AMR combination as identified in the GALL Report. The staff also conducted onsite audits to verify these correlations. A blank in column seven indicates that the applicant was unable to identify an appropriate correlation in the GALL Report. The staff also conducted a technical review of combinations not consistent with the GALL Report. The next column, "Table 1 Item," refers to a number indicating the correlating row in Table 1.

3.0.2.3 FSAR Supplement

Consistent with the SRP-LR for the AMRs and AMPs that it reviewed, the staff also reviewed the FSAR supplement, which summarizes the applicant's programs and activities for managing aging effects for the period of extended operation, as required by 10 CFR 54.21(d).

3.0.2.4 Documentation and Documents Reviewed

In its review, the staff used the LRA, LRA supplements, the SRP-LR, and the GALL Report.

During the onsite audit, the staff examined the applicant's justifications to verify that the applicant's activities and programs will adequately manage the effects of aging on SCs. The staff also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others with technical expertise relevant to aging management.

3.0.3 Aging Management Programs

SER Table 3.0.3-1 presents the AMPs credited by the applicant and described in LRA Appendix B. The table also indicates the SSCs that credit the AMPs and the GALL AMP with which the applicant claimed consistency and shows the section of this SER in which the staff's evaluation of the program is documented.

Table 3.0.3-1 HNP Aging Management Programs

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program (B.2.1)	Existing	Consistent with exception	XI.M1	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.1
Water Chemistry Program (B.2.2)	Existing	Consistent	XI.M2	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion system / containments, structures, and component supports	3.0.3.1.1
Reactor Head Closure Studs Program (B.2.3)	Existing	Consistent with exception	XI.M3	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.2
Boric Acid Corrosion Program (B.2.4)	Existing	Consistent	XI.M10	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion system / containments, structures, and component supports	3.0.3.1.2
Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure of Pressurized Water Reactors Program (B.2.5)	Existing	Consistent with enhancement	XI.M11A	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.3
Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B.2.6)	New	Consistent	XI.M13	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.1.3
Flow-Accelerated Corrosion Program (B.2.7)	Existing	Consistent with enhancement	XI.M17	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion system	3.0.3.2.4

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Bolting Integrity Program (B.2.8)	Existing	Consistent with exceptions and enhancement	XI.M18	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion system	3.0.3.2.5
Steam Generator Tube Integrity Program (B.2.9)	Existing	Consistent with exceptions and enhancements	XI.M19	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.6
Open-Cycle Cooling Water System Program (B.2.10)	Existing	Consistent	XI.M20	auxiliary systems	3.0.3.1.4
Closed-Cycle Cooling Water System Program (B.2.11)	Existing	Consistent with exceptions	XI.M21	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems	3.0.3.2.7
Boraflex Monitoring Program (B.2.12)	Existing	Consistent with enhancements	XI.M22	containments, structures, and component supports	3.0.3.2.8
Inspection of Overhead Heavy Load and Light Load Handling Systems Program (B.2.13)	Existing	Consistent with enhancements	XI.M23	containments, structures, and component supports	3.0.3.2.9
Fire Protection Program (B.2.14)	Existing	Consistent with enhancements	XI.M26	auxiliary systems	3.0.3.2.10
Fire Water System Program (B.2.15)	Existing	Consistent with enhancements	XI.M27	auxiliary systems	3.0.3.2.11
Fuel Oil Chemistry Program (B.2.16)	Existing	Consistent with exception and enhancements	XI.M30	auxiliary systems	3.0.3.2.12
Reactor Vessel Surveillance Program (B.2.17)	Existing	Consistent with enhancements	XI.M31	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.13

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
One-Time Inspection Program (B.2.18)	New	Consistent	XI.M32	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion system / containments, structures, and component supports	3.0.3.1.5
Selective Leaching of Materials Program (B.2.19)	New	Consistent with exceptions	XI.M33	auxiliary systems / steam and power conversion system	3.0.3.2.14
Buried Piping and Tanks Inspection Program (B.2.20)	New	Consistent	XI.M34	auxiliary systems / containments, structures, and component supports	3.0.3.1.6
One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program (B.2.21)	New	Consistent with exceptions	XI.M35	reactor vessel, internals, and reactor coolant system	3.0.3.2.15
External Surfaces Monitoring Program (B.2.22)	Existing	Consistent with enhancements	XI.M36	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion system / containments, structures, and component supports	3.0.3.2.16
Flux Thimble Tube Inspection Program (B.2.23)	Existing	Consistent with enhancements	XI.M37	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.17
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	New	Consistent	XI.M38	auxiliary systems / steam and power conversion system / containments, structures, and component supports	3.0.3.1.7
Lubricating Oil Analysis Program (B.2.25)	Existing	Consistent with enhancement	XI.M39	reactor vessel, reactor vessel internals, and reactor coolant system / auxiliary systems / steam and power conversion system	3.0.3.2.18
ASME Section XI, Subsection IWE Program (B.2.26)	Existing	Consistent with exception and enhancements	XI.S1	containments, structures, and component supports	3.0.3.2.19

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
ASME Section XI, Subsection IWL Program (B.2.27)	Existing	Consistent with exception	XI.S2	containments, structures, and component supports	3.0.3.2.20
ASME Section XI, Subsection IWF Program (B.2.28)	Existing	Consistent with exceptions	XI.S3	containments, structures, and component supports	3.0.3.2.21
10 CFR Part 50, Appendix J Program (B.2.29)	Existing	Consistent with enhancement	XI.S4	containments, structures, and component supports	3.0.3.2.22
Masonry Wall Program (B.2.30)	Existing	Consistent with enhancement	XI.S5	containments, structures, and component supports	3.0.3.2.23
Structures Monitoring Program (B.2.31)	Existing	Consistent with enhancements	XI.S6	containments, structures, and component supports	3.0.3.2.24
RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program (B.2.32)	Existing	Consistent with enhancements	XI.S7	containments, structures, and component supports	3.0.3.2.25
Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.33)	New	Consistent	XI.E1	electrical and instrumentation and controls	3.0.3.1.8
Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements used in Instrumentation Circuits Program (B.2.34)	New	Consistent	XI.E2	electrical and instrumentation and controls	3.0.3.1.9

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Inaccessible Medium-Voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.35)	New	Consistent	XI.E3	electrical and instrumentation and controls	3.0.3.1.10
Metal Enclosed Bus Program (B.2.36)	New	Consistent	XI.E4	electrical and instrumentation and controls	3.0.3.1.11
Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.37)	New	Consistent	XI.E6	electrical and instrumentation and controls	3.0.3.1.12
Reactor Coolant Pressure Boundary Fatigue Monitoring Program (B.3.1)	Existing	Consistent with enhancements	X.M1	reactor vessel, internals, and reactor coolant system	3.0.3.2.26
Environmental Qualification (EQ) Program (B.3.2)	Existing	Consistent	X.E1	electrical and instrumentation and controls	3.0.3.1.13
Oil-Filled Cable Testing Program	Plant-specific			electrical and instrumentation and controls	3.0.3.3.1

3.0.3.1 AMPs Consistent with the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as consistent with the GALL Report:

- Water Chemistry Program
- Boric Acid Corrosion Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Open-Cycle Cooling Water System Program
- One-Time Inspection Program
- Buried Piping and Tanks Inspection Program

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program
- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Metal Enclosed Bus Program
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Environmental Qualification (EQ) Program

3.0.3.1.1 Water Chemistry Program

Summary of Technical Information in the Application. LRA Section B.2.2 describes the existing Water Chemistry Program as consistent with GALL AMP XI.M2, "Water Chemistry."

The applicant's Water Chemistry Program consists of two parts, water chemistry for both the primary and the secondary water systems, implemented with different water chemistry control requirements, procedures, and acceptance criteria.

The applicant stated that to mitigate aging effects on component surfaces exposed to water as process fluid, chemistry programs control water chemistry and impurities (*e.g.*, dissolved oxygen, chlorides, fluorides, and sulfates) that accelerate corrosion and cracking. This program monitors and controls water chemistry to keep peak levels of various contaminants below system-specific limits. Alternatively, introduction of chemical agents (*e.g.*, corrosion inhibitors, oxygen scavengers, and biocides) may prevent some aging mechanisms. The applicant also stated that the HNP Water Chemistry Program is based on the latest version of the Electric Power Research Institute (EPRI) guidelines, "Pressurized Water Reactor Primary Water Chemistry Guidelines, Revision 5," EPRI, Palo Alto, CA, 2003, 1002884, and "Pressurized Water Reactor Secondary Water Chemistry Guidelines – Revision 6," EPRI, Palo Alto, CA: 2004, 1008224. The HNP Water Chemistry Program will be updated as revisions to the guidelines are released.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

During the audit, the staff reviewed the existing Water Chemistry Program license renewal calculation and the applicant's bases document for this AMP directly comparing its ten program elements to those defined and described in GALL AMP XI.M2, "Water Chemistry." The staff also interviewed the applicant's technical personnel and reviewed program implementation and administrative control documents listed in the Audit Report for this LRA review issued in March 2008.

The staff reviewed the program element descriptions in the applicant's license renewal calculation and noted that the Water Chemistry Program is a preventive/mitigative AMP that periodically samples and tests chemical assays of plant coolants to keep contaminant concentrations in the coolants within specified programmatic limits. The staff also noted that the contaminants include, but are not limited to, dissolved oxygen, sulfate, fluoride, chloride, and hydrogen peroxide. The staff noted that the applicant's Water Chemistry Program also maintains concentrations of plant pH-control compounds, reactivity control compounds, oxygen scavengers, and biocides. Examples of these additives are hydrazine, sodium hypochorite, lithium, and boron. Based on its review of the license renewal calculation for the Water Chemistry Program, the staff determines that these activities are consistent with the recommended guidelines of GALL AMP XI.M2, "Water Chemistry," and acceptable.

The staff also noted that the license renewal calculation for the Water Chemistry Program indicates implementation in accordance with recommended guidelines of EPRI Report No. TR-1002884, "PWR Primary Water Chemistry Guidelines" (October 2003), and EPRI Report No. TR-102134, Revision 3, "PWR Secondary Water Chemistry Guidelines" (October 2003), for sampling and quality testing (*i.e.*, chemical assay testing) of plant coolants, the same water quality guideline references of GALL AMP XI.M2, "Water Chemistry." These guidelines also recommend contaminant maximum limits for such coolants. The contaminants recommended for management in these reports include, but are not limited to, those in the previous paragraph. Based on this review, the staff concludes that the applicant's implementation of the guidelines, practices, and activities recommended in these reports is consistent with the program elements defined and described in GALL AMP XI.M2, "Water Chemistry," and acceptable.

The staff also noted that the applicant has credited either the One-Time Inspection Program or the ASME Code Section XI, Subsection IWB, IWC, and IWD Inservice Inspection Program to verify Water Chemistry Program effectiveness in accomplishing its mitigative function for AMR commodity groups or components for which it is credited. LRA Sections B.2.1 and B.2.18 describe the applicant's ASME Code Section XI, Subsection IWB, IWC, and IWD Inservice Inspection Program and its One-Time Inspection Program, respectively. SER Sections 3.0.3.2.1 and 3.0.3.1.5 evaluate the ability of the ASME Code Section XI, Subsection IWB, IWC, and IWD Inservice Inspection Program and of the One Time Inspection Program, respectively, to manage aging.

Based on its review, the staff finds the Water Chemistry Program consistent with the program elements in GALL AMP XI.M2, "Water Chemistry," and acceptable

Operating Experience. LRA Section B.2.2 states that the EPRI guideline documents have been developed based on plant experience and shown to be effective over time with their widespread use in the industry; however, there is potential for stress corrosion cracking (SCC) due to inadvertent introduction of contaminants into the primary coolant system from unacceptable contaminant levels in the boric acid or through the free surface of the spent fuel pool (which can be a natural collector of airborne contaminants) or introduction of oxygen during cooldown. Ingress of demineralizer resins into the primary system has caused intergranular stress corrosion cracking (IGSCC) of Alloy 600 vessel head penetrations. The applicant stated that inadvertent introduction of sodium thiosulfate into the primary system has caused IGSCC of steam generator tubes. SCC has occurred in safety injection lines, charging pump casing cladding, instrument nozzles in safety-injection tanks, and stainless steel piping systems that contain oxygenated, stagnant, or essentially stagnant borated coolant. Steam generator tubes and plugs and Alloy 600 penetrations have experienced primary water SCC. Steam generator tubes have experienced SCC, intergranular attack, wastage, and pitting. Carbon steel support plates in steam generators have experienced general corrosion. The steam generator shell has experienced pitting and stress corrosion cracking.

The applicant also stated that has reviewed the industry operating experience with maintenance of a benign environment described in the GALL Report for applicable recommendations.

The applicant further stated that a review of systematic assessment of applicant performance reports from 1988 through 1998 concluded that the Water Chemistry Program was well maintained with performance well within regulatory limits. Review of integrated inspection reports from 1999 through 2006 indicated no adverse trends or violations for the Water Chemistry Program.

The applicant noted that it has assessed the Water Chemistry Program ten times from 1997 through 2005. These assessments have found issues and weaknesses to be addressed but have concluded that the Water Chemistry Program is effective in the support of the plant.

The applicant's operating experience review of the Water Chemistry Program concluded that this program is upgraded continually based on industry experience and research. These continual upgrades assure that the Water Chemistry Program capability to support the safe plant operation throughout the period of extended operation.

During the audit, the staff reviewed Water Chemistry Program operation records, interviewed plant chemistry personnel responsible for program implementation, and determined that, in addition to taking water chemistry samples, performing the defined chemistry assays and tests on them, and recording the test results, such personnel are also responsible for detecting and addressing in nuclear condition reports (NCRs) any adverse chemistry events or excursions that could impact program effectiveness or plant safety.

The staff reviewed six Water Chemistry Program NCRs for whether the applicant had addressed operational program implementation data, focusing particularly on the following safety-related aspects of nuclear operations:

- one NCR on maintenance of a minimum required sodium hydroxide concentration in containment spray additive tank

- one NCR on maintenance of a minimum required boric acid concentration in the boric acid tank

- one NCR on maintenance of an acceptably low oxygen concentration in the reactor coolant

- three NCRs on maintenance of an acceptable lithium concentration in the reactor coolant for pH control

The staff determined that in each of these NCRs the applicant had analyzed the adverse condition sufficiently to identify the root cause or causes and had taken appropriate corrective actions to bring the chemistry parameter within an acceptable range defined in water chemistry control procedures. Based on this review, the staff concludes that the applicant has appropriate controls in effect to detect water chemistry events that could impact plant safety or the effectiveness of the Water Chemistry Program in accomplishing its intended function of preventing or mitigating corrosion-induced aging effects and that the applicant takes appropriate actions to correct any such events.

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.

FSAR Supplement. In LRA Section A.1.1.2, the applicant provided the FSAR supplement for the Water Chemistry Program. The staff reviewed this section and determines that the information in the FSAR 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 Water Chemistry Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Boric Acid Corrosion Program

Summary of Technical Information in the Application. LRA Section B.2.4 describes the existing Boric Acid Corrosion Program as consistent with GALL AMP XI.M10, "Boric Acid Corrosion."

The The applicant stated that the Boric Acid Corrosion Program implements systematic measures to prevent leaking borated coolant from leading to degradation of the leakage source or of adjacent mechanical, electrical, and structural components susceptible to boric acid corrosion. The program consists of (1) visual inspection of external surfaces potentially exposed to borated water leakage, (2) timely discovery of leak paths and removal of boric acid residues, (3) assessment of damage, and (4) follow-up inspection for adequacy of corrective actions. The Boric Acid Corrosion Program includes plant-specific reactor coolant pressure boundary (RCPB) boric acid leakage identification and inspection procedures to prevent leaking borated coolant from leading to degradation of the leakage source or adjacent structures and assures for the RCPB an extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture. The program was developed in response to recommendations of NRC Generic Letter 88-05.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

During the audit, the staff reviewed the Boric Acid Corrosion Program and compared its program elements to those defined and described in GALL AMP XI.M10, "Boric Acid Corrosion Program." The staff also reviewed the license renewal basis calculation for the applicant's Boric Acid Corrosion Program and interviewed the applicant's personnel responsible for its implementation.

In Generic Letter (GL) 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," the staff informed the US nuclear power industry that borated water leakage is a safety issue for pressurized-water reactor (PWR) reactor coolant pressure boundaries and recommended to PWR facility licensees visual examinations of their borated water systems to monitor leakage that could impact the integrity of plant systems made from ferritic (*i.e.*, carbon or low-alloy) steel materials. The program elements of GALL AMP XI.M10, "Boric Acid Corrosion Program," are based on the leakage examinations recommended in GL 88-05.

The license renewal basis calculation for this AMP indicates that the applicant developed its Boric Acid Corrosion Program in accordance with GL 88-05 recommendations for system walkdowns. The staff determined, from review of the "scope of program" and "detection of aging effects" program element descriptions in the license renewal basis calculation, that (1) the existing Boric Acid Corrosion Program has procedures for condition monitoring, (2) the applicant based the AMP on GL 88-05, (3) the scope of the AMP incorporates system walkdowns and visual VT-2 examinations of ferritic (*i.e.* carbon or alloy) steel components that could be exposed to leakage of borated water or to boric acid residues or precipitates of such leakage, and (4) the supplemented scope of the program incorporates industry or plant-specific operating experience. Such incorporation is consistent with the "scope of program" and "detection of aging effects" program elements of GALL AMP XI.M10, "Boric Acid Corrosion," and acceptable.

The staff noted that the Boric Acid Corrosion Program is not preventive or mitigative; therefore, it does not include activities defined in accordance with the "preventive actions" program element of Branch Technical Position (BTP) RSLB–1.

The staff determined from its review of the "parameters monitored" program element in the license renewal basis calculation that the program monitors for loss of material (wastage) to boric acid corrosion. Such monitoring is consistent with the "parameters monitored" program element of GALL AMP XI.M10, "Boric Acid Corrosion," and acceptable.

The staff determined, from its review of the "monitoring and trending" and "acceptance criteria" program elements and the supporting procedures in the license renewal basis calculation, that the AMP's system walkdowns at every refueling outage include appropriate acceptance criteria for component sources of borated water leakage and for ferritic steel components exposed to borated water leakage. Specifically, the program states the evidence of leakage is unacceptable and requires entry of any components impacted by borated water leakage into the applicant's 10 CFR Part 50, Appendix B Corrective Action Program. This practice is consistent with the "monitoring and trending" and "acceptance criteria" program elements of GALL AMP XI.M10, "Boric Acid Corrosion," and acceptable.

The staff determined, from its review of the "corrective actions" program element and supporting procedures in the license renewal basis calculation, that the program also includes corrective actions to remove boric acid residues from components exposed to borated water leaks and to repair or replace component sources of the leaks. The program controls these corrective actions in accordance with the applicant's 10 CFR Part 50, Appendix B Program. These activities are consistent with the "corrective actions" program element of GALL AMP XI.M10, "Boric Acid Corrosion," and acceptable.

HNP technical specifications establish limits for RCPB leakage, unidentified RCS leakage, and identified RCS non-RCPB leakage. The staff asked the applicant to clarify what activities or actions distinguish the different types of leakage upon discovery of RCS leakage and whether the Boric Acid Corrosion Program implementation procedure incorporates such activities.

In its response dated August 20, 2007, the applicant stated:

> Attachment 2 to HNP Correspondence, Serial: HNP-07-015, "Shearon Harris Nuclear Power Plant, Unit No. 1 Inspection and Mitigation of Alloy 82/182 Pressurizer Butt Welds," provides a discussion of reactor coolant system (RCS) leakage monitoring. Additionally, HNP FSAR, Section 5.2.5, "Detection of Leakage Through Reactor Coolant Pressure Boundary," provides a detailed discussion of this topic.

The applicant's response indicates that CP&L Letter No. HNP-07-015, "Shearon Harris Power Plant, Unit No. 1 Inspection and Mitigation of Alloy 82/182 Pressurizer Butt Welds," dated January 31, 2007, state the basis for enhanced monitoring for RCS leakage (a source of borated water leakage) and for differentiation between RCPB leakage, unidentified RCS leakage, and identified RCS non-RCPB leakage. CP&L Letter No. HNP-07-015 defined the applicant's programmatic method for enhanced system leakage monitoring of its RCS, established trigger points for corrective actions upon detection of RCS leakage, and made regulatory commitments for implementing this program.

The applicant amended CP&L Letter No. HNP-07-015 in CP&L Letter No. HNP-07-026, "Shearon Harris Power Plant, Unit No. 1 Inspection and Mitigation of Alloy 82/182 Pressurizer Butt Welds," dated February 27, 2007, which supplemented both the applicant's response to the staff's questions on RCS leakage monitoring and the commitments in CP&L Letter No. HNP-07-015 with additional commitments on RCS system leakage monitoring and implementation of weld overlays on nickel alloy pressurizer welds susceptible to primary water stress corrosion cracking (a source of RCS leakage if an existing crack propagated throughwall).

The applicant's response to the staff's question is acceptable because (1) the response indicates that CP&L Letter No. HNP-07-015, as amended in CP&L Letter No. HNP-07-026, states the applicant's basis for enhanced monitoring for RCS leakage (a source of borated water leakage) and for differentiation between RCPB leakage, unidentified RCS leakage, and identified RCS non-RCPB leakage and (2) the staff approved the applicant's basis for enhanced leakage monitoring in a letter dated March 22, 2007. The staff's question is resolved.

The relevant information in LRA Section B.2.4, the license renewal basis calculation for this AMP, the applicant's response to GL 88-05, and the applicant's response to the staff's question as well as the applicant's additional commitments for enhanced leakage monitoring demonstrate that the applicant will continue to implement appropriate system walkdowns, monitor for borated water leakage and evidence of wastage, and correct any adverse conditions caused by such leakage. Based on this information, the staff concludes that the program elements for the applicant's Boric Acid Corrosion Program are consistent with those of GALL AMP XI.M10, "Boric Acid Corrosion Program," without exception and acceptable.

Operating Experience. LRA Section B.2.4 states that the Boric Acid Corrosion Program is implemented and maintained in accordance with the general requirements for engineering programs for assurance of effective implementation to meet regulatory and procedural requirements, including periodic assessments and reviews of operating experience. Qualified personnel assigned as program managers have authority and responsibility to implement the Boric Acid Corrosion Program and commit adequate resources to program activities.

The applicant's review of responses to NRC generic correspondence, plant condition reports, and self-assessments and inspections showed the Boric Acid Corrosion Program as critically monitored and continually improving. These results of the operating experience review prove that Boric Acid Corrosion Program practices will continue to assure the integrity of subject components.

The staff noted that the applicant controls its system walkdowns of the borated systems by a corporate boric acid leakage control program and a designated program manger responsible for managing, controlling, and implementing borated water system monitoring. These activities review any plant-specific experience and industry operating experience on boric acid leakage events and factor such experience into the visual examinations scheduled and implemented by the program. The staff noted that this industry experience includes NRC generic communications on borated coolant leakage, including:

- NRC Order EA-03-009 and its first revision (collectively "NRC Order EA-03-009"): This order states NRC augmented ISI requirements for monitoring for reactor coolant leakage from upper reactor pressure vessel head (RPVH) penetration nozzles.

- NRC Bulletin 2003-02: This bulletin states NRC augmented inspection recommendations for monitoring for reactor coolant leakage from lower RPVH nozzles and their nickel alloy welds in PWRs

- NRC Bulletin 2004-01: This bulletin states NRC augmented inspection recommendations for monitoring for reactor coolant leakage from nickel alloy components and nickel alloy weld materials in PWR pressurizers.

The staff asked the applicant whether the Boric Acid Corrosion Program incorporated industry operating experience and the applicant's commitments to enhanced leakage monitoring of the upper reactor vessel closure head (RVCH) penetration nozzles (including their nickel-alloy J-groove welds), lower RVCH bottom-mounted instrumentation nozzles (including their nickel-alloy J-groove welds), and nickel-alloy penetration welds in the pressurizer system.

The applicant's response dated August 20, 2007, indicated that the AMP makes these commitments in the following documents:

- CP&L Letter No. HNP-03-023, "Shearon Harris Nuclear Power Plant, Unit No. 1, Docket No. 50-400 / License No. NPF-63, Twenty-Day Response to Order for Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," as amended in CPL Letter No. HNP-04-045, dated May 9, 2004.

- CP&L Letter No. HNP-03-118, "90-Day Response to NRC Bulletin 2003-02, Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity," November 13, 2003.

- CP&L Letter No. HNP-04-097, "60-Day Response to Bulletin 2004-01 for the Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized Water Reactors," July 27, 2004.

Based on the applicant's response to the question, the staff determined that the scope of the Boric Acid Corrosion Program includes the applicant's responses to these generic communications and any commitments made to the NRC for enhanced RCS leakage monitoring of the nickel-alloy components in or attached to the upper RVCH, lower RVCH, or pressurizer system, including nickel-alloy structural welds. The staff also determined that the applicant's bare metal examinations of those components are as recommended in generic communications. SER Section 3.0.3.2.1 documents the staff's summary of the applicant's responses to these generic communications and the staff's evaluation of the applicant's activities and commitments to inspect these components for leakage. Based on this review, the staff concludes that the applicant has factored industry experience with borated water leakage into the scope of the Boric Acid Corrosion Program to include enhanced RCS leakage monitoring from ASME Class 1 nickel-alloy components more comprehensive than that of the original commitment to the NRC in the applicant's response to GL 88-05. The staff's question is resolved.

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.

FSAR Supplement. In LRA Section A.1.1.4, the applicant provided the FSAR supplement for the Boric Acid Corrosion Program. The staff reviewed this section and determines that the information in the FSAR 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 Boric Acid Corrosion Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

Summary of Technical Information in the Application. LRA Section B.2.6 describes the new Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)."

The applicant stated that the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program will be implemented as an augmented inservice inspection (ISI) program to detect the effects of loss of fracture toughness due to thermal aging and/or neutron irradiation embrittlement of CASS reactor vessel internals. These inspections will be augmented visual inspections already required by American Society of Mechanical Engineers (ASME) Code Section XI, Subsection IWB, Category B-N-3. Components within the scope of this augmented inspection program include CASS reactor vessel internals components potentially susceptible to thermal aging and/or subjected to neutron fluence of greater than 10^{17} n/cm^2 (E>1 MeV). Susceptibility to loss of fracture toughness due to thermal embrittlement is based on the criteria stated in the May 19, 2000, letter from Christopher Grimes, NRC, to Mr. Douglas Walters, NEI. For components susceptible to loss of fracture toughness due to thermal embrittlement and/or neutron irradiation embrittlement, the program provides for a component-specific evaluation, including a mechanical loading assessment, to determine whether the loading is compressive or low enough to preclude fracture.

The applicant further stated that component inspections and/or evaluations must consider the recommendations of GALL AMP XI.M13. The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program will manage loss of fracture toughness due to thermal aging and/or neutron irradiation embrittlement in CASS reactor vessel internals components within the scope of license renewal to maintain system intended function through the period of extended operation. This program will be implemented and required inspections completed and evaluated during the last 10-year ISI Interval prior to the period of extended operation. Inspections of potentially susceptible components will continue during the period of extended operation.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

During the audit, the staff interviewed the applicant's technical personnel and reviewed Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program documentation, including the license renewal program evaluation report, which assesses consistency of the program elements with GALL AMP XI.M13 elements.

During the review, the staff noted the applicant's statement, in the description section of the program, that, "Susceptibility to loss of fracture toughness due to thermal embrittlement is based on the criteria stated in the May 19, 2000, letter from Christopher Grimes, NRC, to Mr. Douglas Walters, NEI." During the audit, the staff asked the applicant whether such criteria had screened out any component/commodity from program management.

The applicant responded that the screening criteria in the Christopher Grimes letter dated May 19, 2000, have screened out no components from management by this program.

During the audit, the staff reviewed the ten program elements described in the applicant's license renewal program evaluation report and interviewed the applicant's technical personnel to confirm the applicant's claim of consistency with the GALL Report. The staff noted that the "corrective actions" program element of GALL AMP XI.M13 states that repair is in conformance with IWA-4000 and IWB-4000 and replacement in accordance with IWA-7000 and IWB-7000; however, the applicant's calculation states that repairs and replacements will be in accordance with Subsection IWA as required by the 1989 Edition of ASME Code Section XI. The staff considered this statement an exception to the GALL AMP "corrective actions" program element and asked the applicant to explain this inconsistency and to clarify whether an LRA revision would address it as LRA Section B.2.6 claims consistency (with no exception) with GALL AMP XI.M13.

The applicant's response dated August 20, 2007, stated that HNP uses the 1989 Edition of ASME Code Section XI (the Code) to determine repair/replacement requirements. Repairs are in accordance with Article IWA-4000 and the corresponding IWX-4000 of the IWB/C/D portions of the Code, replacements with Article IWA-7000 and the corresponding IWX-7000 of the IWB/C/D portions. HNP is updating the ISI program to the ASME Code Section XI, 2001 Edition with addenda through 2003, per 10 CFR 50.55a. Article IWA-4000 controls all repairs/replacements in this Code edition and its addenda. ASME Code Section XI states, "The term repair/replacement activity includes those activities previously known as repair, replacements, modification, or alteration." IWA-4000 has incorporated all ASME Code Section XI IWX-4000 and IWX-7000 articles. The response added that an amended LRA would address this exception.

The same letter dated August 20, 2007, proposed an amendment to LRA Section B.2.6 to add such an exception to the "corrective actions" program element.

On the basis of the applicant's clarification in its response that IWA-4000 has incorporated all of the Section XI IWX-4000 and IWX-7000 articles, the staff finds the response and the exception to the "corrective actions" element of this program acceptable.

Operating Experience. LRA Section B.2.6 states that this AMP for thermal aging and neutron irradiation embrittlement of CASS is new. There is no plant-specific operating experience to validate the effectiveness of this program.

The GALL Report is based on industry operating experience through January 2005. The applicant stated it has reviewed more recent industry operating experience for applicability through the normal operating experience review process, which will continue through the period of extended operation.

The staff reviewed a sample of plant-specific operating experience and interviewed the applicant's technical personnel to confirm that it revealed no 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.

FSAR Supplement. In LRA Section A.1.1.6, the applicant provided the FSAR supplement for the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. This section states that the new Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program will manage loss of fracture toughness of CASS reactor vessel internals due to thermal aging, neutron irradiation embrittlement, or both.

In Enclosure 1 of its response dated November 14, 2006, the applicant committed (Commitment No. 4) to implement the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program prior to the period of extended operation. The staff reviewed this commitment and LRA Section A.1.1.6 and determines that the information in the FSAR 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 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program, the staff finds all program elements, with the exception noted in the August 20, 2007, letter (and found acceptable by the staff) for "corrective actions," consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 Open-Cycle Cooling Water System Program

Summary of Technical Information in the Application. LRA Section B.2.10 describes the existing Open-Cycle Cooling Water System Program as consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System."

The applicant stated that the Open-Cycle Cooling Water System Program implements the recommendations of Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," and the guidance in its supplement, Generic Letter 89-13, Supplement 1, to manage the effects of aging on open-cycle cooling water (OCCW) systems for the period of extended operation. The program's surveillance and control techniques manage aging effects caused by biofouling, corrosion, erosion, and silting in the OCCW systems or structures and components serviced by the OCCW systems. The Open-Cycle Cooling Water System Program addresses the emergency service water (ESW) system and safety-related portion of the normal service water (NSW) system (*i.e.*, piping and components of its containment isolation). The program scope includes safety-related components and flow paths in the ESW and NSW systems subjected to a raw water environment.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed an HNP plant program document stating commitments to address GL 89-13 and confirmed that the applicant has processes in place to implement GL 89-13 recommendations that large diameter piping is internally coated carbon steel and other system piping and piping components are constructed of either carbon steel, corrosion resistant material, or coated. Small bore, carbon steel piping in stagnant flow locations is periodically flushed or lines replaced to prevent flow blockage. The staff further confirmed that in accordance with plant procedures the program periodically inspects the intake structure, applies a chemical treatment to mitigate microbiologically-influenced corrosion (MIC) and the buildup of biological fouling, inspects heat exchangers and other components, and takes corrective actions, including ultrasonic testing, when inspections detect loss of material. The GL 89-13 plant program document requires eddy current testing of heat exchanger tubes to detect wall thinning. Finally, the staff reviewed the plant procedure for raw water system inspections and confirmed that its criteria maintain coating integrity, detect and repair corrosion and heat exchanger fouling, and remove flow blockages due to fouling.

Operating Experience. LRA Section B.2.10 states that recent system operating history shows that the Open-Cycle Cooling Water System Program has been effective in detecting and mitigating leaks as well as in preventing equipment failures related to fouling and flow blockage. The applicant stated that the plant-specific and industry operating experience show the following aging effects and/or mechanisms: (a) localized pin-hole leakage, (b) erosion of system components (*e.g.*, pumps and pump discharge strainers), (c) corrosion, (d) flow blockage in small-bore, stagnant lines due to silting and corrosion products, (d) partial blockage from silting in cooling header to diesel jacket water coolers, and (e) minor amounts of biological organisms and silt deposits in the intake bays. Fouling due to manganese deposits has been detected in system heat exchangers. Initiated chemistry control measures (*e.g.*, addition of manganese dispersants) have ameliorated this concern to a large extent. These measures are still parts of the ongoing inspections and cleaning efforts of this program. Requirements for addressing these issues are formalized in the Open-Cycle Cooling Water System Program and these items are included in the Corrective Action Program.

The staff's audit and review of a series of operating experience documents included GL 89-13 program self-assessments which provided an overview of program effectiveness. As the foundation of the Open-Cycle Cooling Water Program addressing service water fouling concerns in general, this particularly relevant self-assessment concluded that the GL 89-13 program effectively meets GL 89-13 commitments, maintains service water system safety-related function capability, and translates the commitments into the governing plant program document and into plant procedures and processes. The staff also reviewed an internal evaluation report on the applicant's GL 89-13 test/inspection program documenting the evaluation of testing and inspection results from October 16, 2002, to May 16, 2004, indicating issues identified and appropriate corrective actions taken (*e.g.*, replacement of some carbon steel valves with stainless steel valves as well as continued flushing and periodic replacement of small bore piping). Overall, inspection and test results for this period indicated no significant problems or trends other than those already managed by the Corrective Action 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.

FSAR Supplement. In LRA Section A.1.1.10, the applicant provided the FSAR supplement for the Open-Cycle Cooling Water System Program. The staff reviewed this section and determines that the information in the FSAR 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 Open-Cycle Cooling Water System Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 One-Time Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.18 describes the new One-Time Inspection Program as consistent with GALL AMP XI.M32, "One-Time Inspection."

The One-Time Inspection Program uses one-time inspections to verify AMP effectiveness and confirm the absence of an aging effect. The program includes inspections specified by the GALL Report as well as plant-specific inspections where inspection results can be extrapolated reasonably through the period of extended operation.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff interviewed the applicant's technical personnel and reviewed its license renewal basis calculation and other basis documents and procedures for the One-Time Inspection Program to determine whether its program elements are consistent with program element criteria recommended in GALL AMP XI.M32, "One-Time Inspection."

From its review of the license renewal basis calculation, the staff determined that the applicant credits its new One-Time Inspection Program to verify whether (1) other preventive- or mitigative-based AMPs within the scope of license renewal (*e.g.*, the Water Chemistry Control Program) effectively prevent or mitigate the aging effects for which they are credited or (2) aging effects have occurred (initiated) in the components or structures for which this AMP is credited and for which there is no recorded operating experience.

By letter dated August 20, 2007, the applicant amended LRA Section B.2.18 with additional details of the scope of the One-Time Inspection Program and its program elements. Specifically, the applicant clarified the aging effects to be monitored within the scope of the AMP and the inspection techniques for monitoring for these aging effects as shown in Table 3.0.3.1.5-1:

Table 3.0.3.1.5-1 Aging Effects and Inspection Methods Within the Scope of the One-Time Inspection Program

Aging Effect/Mechanism	Inspection Techniques for Detection of Aging Effect
Loss of Material due to Crevice/Pitting Corrosion	Visual (*e.g.*, VT-1), volumetric, or both
Loss of Material due to General or Galvanic Corrosion or to MIC	Visual (*e.g.*, VT-3), volumetric, or both
Loss of Material due to Erosion	Visual (*e.g.*, VT-3), volumetric, or both
Fouling	Visual (*e.g.*, VT-3), volumetric, or both
Cracking	Enhanced Visual, volumetric, or both

The staff compared the aging effects and inspection techniques described in the letter dated August 20, 2007, to those of GALL AMP XI.M32, "One-Time Inspection," and determined that the inspection techniques for the applicant's One-Time Inspection Program are consistent with those recommended in GALL AMP XI.M32 for comparable aging effects.

The applicant credits the One-Time Inspection Program to manage loss of material due to flow-accelerated corrosion in the steam generator feedwater distribution ring but its table in the "parameters monitored/inspected" program element in the letter dated August 20, 2007, showed no inspection techniques for managing loss of material due to such corrosion. The staff asked the applicant how it could credit a one-time inspection for these components without defining inspection techniques for managing loss of material due to flow-accelerated corrosion.

In RAI 3.1.2.2.14-1 the applicant was asked to clarify how the One-Time Inspection will manage loss of material due to flow-accelerated corrosion. By letter dated December 11, 2007, the applicant stated:

> HNP inspected the interior of the feedwater inlet ring of the "B" and "C" steam generators during Refueling Outage 13 in 2006. This inspection was accomplished by employing remote visual equipment with recording capabilities. The interior inspection performed in 2006 will provide a basis for comparison with the results of a future

inspection in accordance with the One-Time Inspection Program. Alternative techniques to remote visual may be utilized to inspect the feedwater distribution ring and related components for loss of material due to flow accelerated corrosion depending on industry operating experience with the Westinghouse Delta 75 steam generators and development of additional inspection techniques.

Based on this assessment, the staff concluded that the One-Time Inspection Program inspection techniques for monitoring these aging effects are consistent with the techniques recommended in GALL AMP XI.M32, "One-Time Inspection," for such aging effects and acceptable.

The staff also noted that the applicant's response dated August 20, 2007, amended LRA Section B.2.18 description of the "detection of aging effects" and "monitoring and trending" program elements for the One-Time Inspection Program:

> Sample size would be based on considerations, such as, accessibility, leading or bounding locations, safety significance, severity of operating conditions, and design margins. Progress Energy non-destructive examination (NDE) procedures and personnel qualifications meet the requirements of the ASME Code, where applicable. Administrative controls and quality assurance requirements for NDE activities are implemented in accordance with 10 CFR 50, Appendix B. Inspections may be performed together with ASME inservice inspection activities, and they will be designed to ascertain if detrimental aging effects are occurring. In general, inspections will be scheduled to be accomplished no earlier than 10 years prior to the period of extended operation.
>
> The One-Time Inspection Program is not intended to be a monitoring or trending program; should degradation be encountered, it would be evaluated, and if required, monitored or trended, under the Corrective Action Program.

The staff compared these program element descriptions to the corresponding program elements of GALL AMP XI.M32, "One-Time Inspection," and determined that the "detection of aging effects" and "monitoring and trending" program elements for the One-Time Inspection Program are consistent with the programmatic criteria for "detection of aging effects" and "monitoring and trending" recommended in GALL AMP XI.M32. Based on this determination, the staff concluded that the "detection of aging effects" and "monitoring and trending" program elements for the One-time Inspection Program are consistent with the recommendations of GALL AMP XI.M32, "One-Time Inspection," and acceptable.

The staff also determined that the "acceptance criteria" and "corrective actions" program elements for this AMP, as described in the letter dated August 20, 2007, were consistent with the "acceptance criteria" and "corrective actions" program elements recommended in GALL AMP XI.M32, "One-Time Inspection," and acceptable.

The staff reviewed the applicant's letter dated August 20, 2007, and determined that the applicant has committed to implement the One-Time Inspection Program prior to the period of extended operation (Commitment No. 14).

On the basis of its review, the staff concludes that the applicant's One-Time Inspection Program is consistent with program elements recommended in GALL AMP XI.M32, "One-Time Inspection," and acceptable and that the program can verify the effectiveness of other preventive/mitigative AMPs or confirm whether aging effects have initiated in the components or structures for which it is credited.

Operating Experience. LRA Section B.2.18 states that the One-Time Inspection Program is new and that the AMR process ensures that one-time inspections have been prescribed and developed with consideration of plant-specific and industry operating experience.

On the basis of this review, the staff concludes that the LRA need not address operating experience with new One-Time Inspection Program not yet implemented at the facility; however, as it is within the scope of Commitment No. 14, pending resolution of the staff's questions on the adequacy of the inspection techniques to manage flow-accelerated corrosion, the staff concludes that the One-Time Inspection Program will adequately manage the aging effects for which it is credited.

Based on this conclusion, the staff confirmed that the "operating experience" program element for the One-Time Inspection Program is an acceptable exception to the "operating experience" program element criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

FSAR Supplement. In LRA Section A.1.1.18, the applicant provided the FSAR supplement for the One-Time Inspection Program. The staff reviewed this section and determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff reviewed the applicant's letter dated August 20, 2007, where Commitment No. 14 refers to the FSAR supplement section for this AMP as stated in LRA Section A.1.1.18. Based on this review, the staff concludes that the FSAR supplement for this AMP is acceptable because it adequately describes the program and because an appropriate commitment reflects the need to implement it.

Conclusion. On the basis of its audit and review of the applicant's One-Time Inspection Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and, concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Buried Piping and Tanks Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.20 describes the new Buried Piping and Tanks Inspection Program as consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection."

The applicant stated that the Buried Piping and Tanks Inspection Program will manage aging effects on the external surfaces of carbon steel and cast iron piping components buried in soil. There are no buried tanks in the program. The aging effects/mechanisms of concern are loss of material due to general, pitting, crevice, and microbiologically-induced corrosion. To manage the aging effects, this program includes (a) preventive measures (*e.g.,* coatings and wrappings required by design) to mitigate degradation and (b) visual inspections of external surfaces of buried piping components, when excavated, for evidence of coating damage and degradation. The program will manage aging effects on the external surfaces of carbon steel and gray cast iron piping components buried in soil or sand.

The applicant further stated that the detailed procedural requirements for the program will be developed for (1) an appropriate as-found pipe coating and material condition inspection whenever buried piping within the scope of this program is exposed with a minimum frequency of at least every 10-years, (2) an initial inspection within the 10-year period prior to the period of extended operation, (3) development of an inspection checklist, (4) documented inspection, (5) precautions on excavation and use of backfill for license renewal piping, (6) buried piping coating inspection, upon excavation, by personnel qualified to assess its condition, and (7) evaluation of any buried piping coating damage and/or degradation found during inspection by a coating engineer or other qualified individual (*e.g.*, the coatings program manager). Any evidence of damage to the coating or wrapping (*e.g.*, perforations, holidays) will require inspection of the protected components for evidence of loss of material. The program assures effective management of the effects of aging on buried piping components for the period of extended operation.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the HNP engineering change process and confirmed the use of preventive measures like protective coatings/wrappings in buried steel and cast iron piping applications. The staff also reviewed the plant procedure for excavation and backfill and confirmed that in-process inspections minimize the potential for damage during these activities. The staff further confirmed that the procedural changes outlined in LRA Section B.2.20 to implement the remaining GALL Report recommendations are parts of the implementation plan.

The applicant's letter dated August 20, 2007, committed (Commitment No.16) to implementation of this new program prior to the period of extended operation. The staff reviewed the LRA Section A.1.1.20 program description to which Commitment No.16 refers. Based on review of the program description and information from the audit and review, the staff finds that this commitment will implement a program consistent with GALL Report recommendations.

During the audit and review, the staff asked the applicant for its methodology and criteria for determining inspection locations in areas with the highest likelihood of corrosion problems.

In its response dated August 20, 2007, the applicant stated:

The specific locations and methodology have not been determined. HNP will remain abreast of the industry with regard to technologies in use and use site and industry operating experience reviews and Benchmarking to assist in the selection of an appropriate approach. As described in LRA Section B.2.20, detailed procedural requirements for the program will be developed. Areas with highest likelihood of corrosion may be identified based on review of site specific operating experience in which degradation has occurred.

The staff finds this response acceptable because the applicant will remain cognizant of industry techniques and will apply the most effective approach available.

Operating Experience. LRA Section B.2.20 states that industry operating experience shows that carbon steel and cast iron buried components experience corrosion degradation. Critical areas include where the component transitions from above to below ground, where coatings are often missing or damaged.

The applicant stated that leaks in HNP buried piping components have been repaired, a demonstration that leaks have been detected and appropriate corrective actions taken to prevent loss of component intended function in the period of extended operation.

The applicant further stated that based on plant-specific operating experience, periodic excavations of buried piping for inspection will not be specified; however, a minimum frequency of at least one buried piping inspection each 10-years will be required. The Buried Piping and Tanks Inspection Program is new; therefore, operating experience to verify the effectiveness of the program is not available. With additional operating experience, lessons learned may adjust this program.

The staff reviewed selected corrective action documents on leaks in buried piping. Some leaks due to soil settlement were not age-related. Where piping from the jockey fire pump discharge leaked at a mechanical joint further review found the carbon steel bolts heavily corroded due to a lack of protective coatings. This condition was an error of omission because HNP procedures require protective coatings on all mechanical joints. There have been no other such failures over 20 years of operation. The staff's review of plant-specific operating experience confirmed that HNP had detected leaks in the underground piping and taken appropriate corrective actions; furthermore, discussions with HNP personnel confirmed that, as part of the "operating experience" program element, the Buried Piping and Tanks Inspection Program would review new industry experience for potential impact.

During the audit and review, the staff asked the applicant to specify the buried piping systems, locations, and root cause(s) of the leaks experienced and to clarify whether the degraded locations were ASME Code Class and how they had been repaired.

In its response dated August 20, 2007, the applicant stated:

HNP operating experience reviews have identified that underground piping leaks have occurred.

For non-ASME Code Class pipe:

- An underground leak on the discharge line of the diesel driven fire pump. The one GPM leak originated from a 90 degree elbow mechanical joint. The cause of the leak appears to be differential settlement of the soil backfill supporting the fire line. This leak is not considered age-related degradation.

- The 3 inch piping of the jockey fire pump discharge was found to be leaking at a mechanical joint. Some of the carbon steel bolts used to connect the flanges together were found to be extremely corroded to the extent that the bolts were no longer structurally functional. All mechanical joints are required to have a protective coating applied (such as Flaketar coal tar epoxy). These joints did not appear to have any substantial application of protective coating. Flaketar coating was used on the joint prior to backfill.

- The site fire water system contains piping components that are flanged to underground piping, e.g., hydrants, valves, pipe sections. Similar to other piping components, the bolting is required to have protective coatings, e.g., Flaketar coal tar epoxy. The lack of coating in this case was assumed to be an error of omission as no other failures of this nature have been identified in over 20 years of operation.

- A leak was traced to the 12" fire header on the discharge of the motor driven fire pump. The leaks were found at two adjacent mechanical joint flanged connections. This leakage at a buried joint was identified and attributed to soil settlement at a flanged connection and is not considered age-related degradation. A contributing factor is that the gasket loses some of its elasticity due to age and hardens. The leaking flanged connections were replaced using new gaskets and new flanges. Gaskets are considered to be subcomponents of the piping and not credited as pressure boundary components. For license renewal, gaskets are considered to be consumables as discussed in SRP-LR Table 2.1-3.

- A potable water line was installed very close to the yard grade, about one foot below the yard surface north of Unit 2. A forklift carrying materials heavier than a normal forklift traveled over this underground piping. The action of the heavy load movements caused the line to break. This piping leak was due to localized heavy load movements and is not considered age-related degradation.

For ASME Code Class pipe:

- During the 10 year pressure testing of fuel oil system buried piping in Refueling Outage 13, a leak was identified in the diesel fuel oil piping from a main diesel fuel oil storage tank to the day tank. The "A" train piping was unable to hold the required pressure. The leakage was isolated to a section of pipe under the Diesel Generator Building. The section of pipe under the building was abandoned and the underground piping was brought above ground just outside the building. The new piping from the buried line enters the Diesel Generator Building above grade level.

The location of the piping leakage was abandoned in place. The investigation concluded that: 'Due to the location of the leak underneath the EDG Building, the pipe section with the leak could not be visually inspected; the apparent cause is a piping through-wall leak caused by exterior corrosion at a location where the coating was either defective or damaged during installation.' The subject section of diesel fuel oil piping is ASME Code Class 3.

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.

FSAR Supplement. In LRA Section A.1.1.20, the applicant provided the FSAR supplement for the Buried Piping and Tanks Inspection Program and by letter dated August 20, 2007, stated Commitment No. 16 to implement the Buried Piping and Tanks Inspection Program prior to the period of extended operation. The staff reviewed this section and determined that, with Commitment No. 16, the information in the FSAR 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 Buried Piping and Tanks Inspection Program, the staff finds, with Commitment No. 16, all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Technical Information in the Application. LRA Section B.2.24 describes the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components."

The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be implemented by existing predictive maintenance, preventive maintenance, surveillance testing, and periodic testing work order tasks that provide opportunities for the visual inspection of internal surfaces of piping, piping elements, ducting, and components. Periodic internal inspections of components detect component degradation for timely determination of appropriate corrective actions. The program work activities will monitor parameters (*e.g.*, change in material properties, cracking, flow blockage, loss of material, and reduction of heat transfer effectiveness) by visual inspection. The extent and schedule of inspections and testing assure detection of component degradation prior to loss of intended functions.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff interviewed the applicant's technical personnel and reviewed its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program basis documents assessing program consistency with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components."

In particular, the staff reviewed for this AMP the applicant's license renewal basis calculation, which assesses the consistency of the program elements with those recommended in GALL AMP XI.M38. Specifically, the staff compared the program element descriptions (documented in SER Section 3.0.2.1) in the license renewal basis calculation to the program element criteria recommended in GALL AMP XI.M38, "Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components," for whether the program elements for the applicant's AMP were consistent with the guidelines recommended in the GALL AMP.

During the audit, the staff asked the applicant for the definition of "inaccessible components" and how it will inspect such components during the period of extended operation.

The applicant stated that a component in a high-radiation area or with some physical restraint or other condition that would render examination impractical by exposing plant personnel to undue hazard is inaccessible. Components inaccessible during power operations are examined during refueling outages. The applicant clarified that, for components inaccessible due to either physical constraint or personnel hazards, components of similar materials and subject to similar environments may be examined as alternatives with documented justification for their use. The applicant stated that, if the examination of an alternate component finds degradation, an evaluation will justify whether the inaccessible component is acceptable for further service.

The staff concluded that examinations of alternate components are acceptable in managing potential aging in inaccessible components because the applicant will examine similarly-fabricated components exposed to similar environments to evaluate the inaccessible components and will apply the experience gained from the examination to evaluate whether the inaccessible component is acceptable for further service. The staff's question is resolved

Based on its review of the program elements as described in the license renewal basis calculation for the AMP and for which the applicant claimed consistency with program elements of GALL AMP XI.M38, the staff finds the program elements for this AMP consistent with those of GALL AMP XI.M38 and acceptable.

The staff noted that the LRA and the license renewal basis calculation for this new Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program indicate that it will be implemented prior to the period of extended operation. The staff verified that the applicant had included the need to implement the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program prior to the period of extended operation (Commitment No. 20).

On the bases that the new Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Program is consistent with the program elements defined in GALL AMP, XI.M38, "Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components," and within the scope of LRA Commitment No. 20, the staff concludes that the AMP will adequately manage the aging effects for which the LRA credits it.

Operating Experience. LRA Section B.2.24 states that the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program has no operating experience. The applicant stated that the Inspection of Internal Surfaces Program will be implemented via existing predictive maintenance, preventive maintenance, surveillance testing and periodic testing work order tasks that have been in place since the plant began operation and have proven effective at maintaining SSC material condition and detecting unsatisfactory conditions. System engineers review operating experience for possible impact on equipment in their systems. The bases for parameters monitored and inspection intervals are vendor recommendations, historical performance, and industry operating experience. Operating experience is disseminated and evaluated as described in the Operating Experience Program.

The staff reviewed the operating experience in the LRA and interviewed the applicant's technical personnel to confirm whether plant-specific operating experience revealed degradation not bounded by industry operating experience. The staff finds that the Corrective Action Program, which records plant-specific and industry operating experience issues, will review and incorporate operating experience as objective evidence of adequate management of aging effects.

The applicant stated that there is no operating experience for the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is consistent with the corresponding program described in the GALL Report.

The staff asked the applicant for a sample of the plant-specific operating experience for components within the scope of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program even if accumulated under a different AMP. The applicant's response listed three action requests written on these components.

The staff reviewed action requests on the components within the scope of the Inspection of Internal Surfaces In Miscellaneous Piping and Ducting Components Program, which did not monitor and detect the degradation that had occurred: (1) one dated April 24, 2000, on degradation detected in the train 'A' condensate pump suction expansion and (2) another dated March 25, 2001, on detection of an oil leak in the high-pressure seal backup oil pump. The staff determined that the applicant's root-cause analyses of the degradation described in these action reports and its actions taken to repair or replace the impacted components prior to returning them to service had been appropriate. Based on this determination, the staff concluded that the applicant has taken appropriate action to correct any previous degradation detected in components within the scope of this AMP, even though detected by implementation of some other program.

Based on this review, 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.

FSAR Supplement. In LRA Section A.1.1.24, the applicant provided the FSAR supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff reviewed this section and determines that the information in the FSAR 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 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. LRA Section B.2.33 describes the new Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."
The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is credited for the aging management of cables and connections not included in the Environmental Qualification (EQ) Program. Accessible electrical cables and connections installed in adverse environments are inspected visually at least every 10-years for cable and connection jacket surface anomalies (*e.g.*, embrittlement, discoloration, cracking, swelling, or surface contamination) which are precursor indications of conductor insulation aging degradation from heat, radiation, or moisture. An adverse environment is a plant area condition significantly more severe than the specified service condition for the electrical cable or connection. The aging effects or mechanisms of concern are reduced insulation resistance and electrical failure. The technical basis for selecting the sample of cables and connections for inspection is defined in the implementing program document. Sample locations will consider the locations of cables and connections inside and outside containment as well as any known adverse environments.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the information in LRA Section B.2.33 describing the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, interviewed the applicant's technical personnel, and reviewed the program basis documents, specifically the program elements basis documents, for consistency with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The LRA Section B.2.33 program description states that the technical basis for selecting cable and connection samples for inspection is defined in the program implementing document.

During the audit and review, the staff asked the applicant to explain the sample selection method for cables and connections from accessible areas and to clarify whether they represent, with reasonable assurance, all cables and connections included in the program as in GALL AMP XI.E1. The staff asked the applicant also to explain inspection sample expansion and corrective actions if an inspection finds an unacceptable cable or connection condition or situation in a sample.

The applicant's response dated August 20, 2007, stated,

> The sample selection method used in the implementing HNP program document follows the guidance of GALL AMP XI.E1, whereby a representative sample of accessible electrical cables and connections installed in adverse localized environments are visually inspected and represent, with reasonable assurance, all cables and connections in that area. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service condition for the electrical cable or connection. The HNP program utilizes plant operating experience (OE) to determine the plant areas to be inspected. HNP OE is used to identify past cable failures, cables that exhibited the effects of aging, hot spots, and adverse localized environments. Part of this OE review includes conversations with maintenance personnel and the use of environmental surveys. Based on this review of OE, the plant areas to be inspected become localized in nature, consisting of a limited area (or subset) of a much larger plant area or zone. The sample selection of cables and connections inspected within the limited plant area bound all cables and connections in the area since the inspection focuses on the worst case environments.
>
> Corrective actions such as expansion of the sample size will be implemented through the HNP Corrective Action Program. The Corrective Action Program is implemented by the HNP QA Program in accordance with 10 CFR 50, Appendix B.

The staff finds the applicant's response acceptable because (1) the applicant has explained that it utilizes operating experience to determine the plant areas to be inspected and the sample selection method for cables and connections from accessible areas so they represent, with reasonable assurance, all cables and connections consistent with the guidance of GALL AMP XI.E1 and (2) the applicant has clarified that when it finds an unacceptable condition or situation its Corrective Action Program determines whether this same condition or situation could apply to other accessible or inaccessible insulated cables and connections.

The staff finds the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program consistent with the recommended GALL AMP XI.E1 and acceptable.

Operating Experience. LRA Section B.2.33 states that the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program has no plant-specific operating experience; however, as noted in the GALL Report, industry operating experience shows that adverse heat or radiation environments for electrical cables and connections cause visually observable degradation of insulating materials.

The staff reviewed the operating experience in the LRA and interviewed the applicant's technical personnel to confirm whether this program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10.

The LRA states that there is no plant-specific operating experience history for the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. Noting that SRP-LR, Revision 1, Appendix A, Branch Technical Position RLSB-1, states that an applicant may have to submit future operating experience for new programs to confirm their effectiveness, the staff asked the applicant to describe how it would record operating experience to confirm program effectiveness and how it would adjust the program as needed.

The applicant's response dated August 20, 2007, stated:

> Plant-specific and industry wide operating experience was considered in the development of the Appendix B electrical programs. Industry operating experience that forms the basis for these Appendix B electrical programs is included in the operating experience element of the corresponding GALL Report Chapter XI Programs. Plant-specific operating experience was reviewed to ensure that the GALL Report Chapter XI Programs will be effective AMPs for the period of extended operation (PEO). This review is discussed in calculation HNP-P/LR-0300, Attachment 14. This review confirms that the operating experience discussed in the GALL Report Chapter XI Programs is bounding. Operating experience going forward will be captured through the HNP Corrective Action and Operating Experience Programs implemented in accordance with Progress Energy Corporate procedures. This ongoing review of operating experience will continue throughout the PEO and the results will be maintained on site. The Corrective Action and Operating Experience Programs are implemented by the HNP QA Program in accordance with 10 CFR 50, Appendix B. This process will verify that the Appendix B electrical programs continue to be effective in the management of aging effects.

In the same August 20, 2007 letter, the applicant proposed to amend LRA Section B.2.33 to add this information to the "operating experience" program element.

The staff finds the response acceptable because the applicant has considered plant-specific and industry operating experience in the development of this program and has confirmed that the operating experience described in GALL AMP XI.E1 is bounding and that corrective action and operating experience programs implemented in accordance with corporate procedures will record future operating experience.

The staff interviewed the applicant's personnel, reviewed both its calculation and a sample of plant-specific operating experience with program components, and confirmed that plant-specific operating experience revealed no aging effects for components within the scope of this program not bounded by industry operating experience.

On the basis of its review of operating experience and discussions with the applicant's technical personnel, the staff concludes that the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.33, the applicant provided the FSAR supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed this section and determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff also confirmed that the applicant's license renewal commitment list shows this new program as Commitment No. 27 to be implemented prior to the period of extended operation.

Conclusion. The staff finds the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program consistent with all corresponding program elements of the GALL Report.

3.0.3.1.9 Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements used in Instrumentation Circuits Program

Summary of Technical Information in the Application. LRA Section B.2.34 describes the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements used in Instrumentation Circuits Program as consistent with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits." The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program is credited for the aging management of radiation monitoring and nuclear instrumentation cables not included in the Environmental Qualification (EQ) Program. Exposure of electrical cables to adverse environments caused by heat or radiation can result in reduced insulation resistance (IR). An IR reduction is a concern in circuits (*e.g.*, radiation monitoring and nuclear instrumentation circuits) with sensitive high-voltage, low-level signals because it may contribute to signal inaccuracies. For radiation monitoring circuits and the Regulatory Guide

(RG) 1.97 wide range neutron flux monitoring circuits, review of surveillance testing calibration results or findings will detect potential cable system aging degradation. This review will be at least every 10-years with the first review completed before the end of the current license term. Cable systems in excore source, intermediate, and power range nuclear instrumentation circuits will be tested at a frequency not to exceed 10-years based on engineering evaluation with the first testing completed before the end of the current license term. Testing may include IR, time domain reflectometry, current versus voltage, or other testing effective in determining cable system insulation condition. The aging effects of concern are reduced IR and electrical failure.

The scope of this program applies to non-EQ cable systems in process radiation monitoring instrumentation circuits, area radiation monitoring instrumentation circuits, and neutron flux monitoring instrumentation circuits sensitive to IR reduction. GALL AMP XI.E1 does not apply to cables in these instrumentation circuits.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the information in LRA Section B.2.34 describing the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, interviewed the applicant's technical personnel, and reviewed the program basis documents, specifically the program elements basis documents, for consistency with GALL AMP XI.E2.

The staff noted that the scope of GALL AMP XI.E2 covers electrical cables and connections. During the audit and review, the staff asked the applicant to clarify whether the tests include both cables and connections. The applicant's response clarified that the Electrical Cables and Connections Not Subject to10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program includes both cables and connections within the scope of license renewal. The staff finds the applicant's response consistent with the GALL Report recommendation and acceptable.

LRA Section B.2.34 states that for radiation-monitoring and RG 1.97 wide-range neutron flux monitoring circuits, review of calibration results or findings of surveillance testing will detect potential cable system aging degradation. During the audit and review, the staff asked the applicant to clarify whether radiation monitoring and wide-range neutron monitoring cables are disconnected during calibration or surveillance testing.

In a letter dated August 20, 2007, the applicant stated that the radiation monitoring cables are connected as part of the overall loop calibration of the system but that the RG 1.97 wide-range neutron flux monitoring cable systems are disconnected during calibration; therefore, the cable systems in the RG 1.97 wide-range neutron flux monitoring circuits require testing to detect potential cable system aging degradation. The RG 1.97 wide-range neutron flux monitoring circuits are parts of the excore nuclear instrumentation system. Similar to the cable systems in the excore source, intermediate, and power range nuclear instrumentation circuits, the RG 1.97 wide-range neutron flux monitoring circuits will be tested at a frequency not to exceed 10 years based on engineering evaluation with the first testing to be completed before the end of the current license term.

In the same August 20, 2007, letter, the applicant proposed to amend LRA Section B.2.34 to add this information to the program description.

The staff finds the applicant's response acceptable because the program will monitor potential cable system aging degradation in radiation-monitoring and RG 1.97 wide-range neutron flux monitoring circuits consistently with the guidance of GALL AMP XI.E2.

The staff noted that the GALL AMP XI.E2 program description states that exposure of electrical cables to adverse environments caused by heat, radiation, or moisture can reduce IR; however, LRA Section B.2.34 states that exposure of electrical cables to adverse environments caused by heat or radiation can reduce IR. The staff asked the applicant to explain why moisture is not specified as a cause of reduced IR as in GALL AMP XI.E2 and to clarify whether all instrumentation circuits susceptible to moisture and sensitive to signal inaccuracies are included in the Environmental Qualification (EQ) Program.

The applicant responded that the LRA Section B.2.34 summary-level program information does not exclude moisture, that the LRA Section B.2.34 conclusion includes moisture as well as heat and radiation, and that LRA Section 3.6.2.1.1 environments include moisture as a stressor. The applicant also stated that not all instrumentation circuits susceptible to moisture and sensitive to signal inaccuracies are in the Environmental Qualification (EQ) Program. To discover circuits not in that program, the applicant screened against GALL AMP XI.E2 criteria all impedance-sensitive circuits within the scope of license renewal likely to experience reduced IR due to heat, radiation, or moisture. The resultant list of impedance-sensitive neutron and radiation-monitoring signal cables that may experience reduced IR is in LRA Section B.2.34. The staff reviewed the program basis documents that screened the circuits within the scope of this program. Based on the review, the staff determined that the applicant appropriately considered the adverse environments and specified consistently with GALL Report recommendations the circuits that could experience reduced IR.

The staff finds the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program consistent with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," and acceptable.

Operating Experience. LRA Section B.2.34 states that the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program has no operating experience; however, as noted in the GALL Report, industry operating experience shows that exposure of electrical cables to adverse environments caused by heat or radiation can result in reduced IR, which causes an increase in leakage currents between conductors and from conductors to ground. IR reduction is a concern in circuits (*e.g.*, radiation monitoring and nuclear instrumentation circuits) with sensitive high-voltage, low-level signals because it may contribute to signal inaccuracies.

The staff reviewed the operating experience in the LRA and interviewed the applicant's technical personnel to confirm whether this program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10.

The LRA states that there is no plant-specific operating experience history for the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program. Noting that SRP-LR, Revision 1, Appendix A, Branch Technical Position RLSB-1, states that an applicant may have to submit future operating experience for new programs to confirm their effectiveness, the staff asked the applicant to describe how it would record operating experience to confirm program effectiveness and how it would adjust the program as needed.

In its response dated August 20, 2007, the applicant stated:

> Plant-specific and industry wide operating experience (OE) was considered in the development of the Appendix B electrical programs. Industry operating experience that forms the basis for these Appendix B electrical programs is included in the operating experience element of the corresponding GALL Report Chapter XI Programs. Plant-specific operating experience was reviewed to ensure that the GALL Report Chapter XI Programs will be effective AMPs for the PEO. This review is discussed in calculation HNP-P/LR-0300, Attachment 14. This review confirms that the operating experience discussed in the GALL Report Chapter XI Programs is bounding. Operating experience going forward will be captured through the HNP Corrective Action and Operating Experience Programs implemented in accordance with Progress Energy corporate procedures. This ongoing review of operating experience will continue throughout the PEO and the results will be maintained on site. The Corrective Action and Operating Experience Programs are implemented by the HNP QA Program in accordance with 10 CFR 50, Appendix B. This process will verify that the Appendix B electrical programs continue to be effective in the management of aging effects.

In the same August 20, 2007 letter, the applicant proposed to amend LRA Section B.2.34 to add this information to the "operating experience" program element.

The staff finds the response acceptable because the applicant has considered plant-specific and industry operating experience in the development of this program and confirmed that corrective action and operating experience programs implemented in accordance with corporate procedures will record future operating experience.

The staff interviewed the applicant's personnel, reviewed its program basis calculation and a sample of plant-specific operating experience with program components, and confirmed that plant-specific operating experience revealed no aging effects for components within the scope of this program not bounded by industry operating 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.

<u>FSAR Supplement</u>. In LRA Section A.1.1.34, the applicant provided the FSAR supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program. The staff reviewed this section and

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

The staff also confirmed that the applicant's license renewal commitment list shows this new program as Commitment No. 28 to be implemented prior to the period of extended operation.

Conclusion. On the basis of its audit and review of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 Inaccessible Medium-Voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. LRA Section B.2.35 describes the new Inaccessible Medium-Voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as consistent with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is credited for aging management of cables not included in the Environmental Qualification (EQ) Program. In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested at least every 10-years for an indication of the condition of the conductor insulation. The specific type of test to be determined will be proven (*e.g.*, power factor, partial discharge, polarization index) or other state-of-the-art testing at the time of the test for detecting deterioration of the insulation system due to wetting. Significant moisture is defined as periodic exposures (*e.g.*, cable in standing water) that last more than a few days. Periodic exposures (*e.g.*, normal rain and drain) that last less than a few days are not significant. Significant voltage exposure is defined as subject to system voltage for more than 25 percent of the time. Manholes for inaccessible non-EQ medium-voltage cables will be inspected for water accumulation and drained as needed. The manhole inspection frequency will be based on actual field data and shall not exceed two years.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the information in LRA Section B.2.35 describing the new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, interviewed the applicant's technical personnel, and reviewed the program basis documents, specifically the program elements basis documents, for consistency with GALL AMP XI.E3.

During the audit and review, the staff asked the applicant whether the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program includes all medium-voltage cables within the scope of license renewal and, if not, for a listing of such cables installed at HNP showing how the program screened them out. In response the applicant stated that it had included in the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program only medium-voltage cables within the scope of license renewal meeting certain GALL AMP XI.E3 criteria: (1) they are located underground and assumed wet and (2) they are energized at least 25 percent of the time. HNP screened out medium-voltage cables within the scope of license renewal not meeting these criteria and did not include them in the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed the program basis calculation and plant drawings showing screening criteria, component and service descriptions, and reasons for exclusion for cables not included in the program. Based on the review, the staff determined that the applicant's program basis calculation appropriately considered, in accordance with GALL AMP XI.E3 recommendations, medium-voltage power cables most likely to be exposed to wet environments.

The staff finds the applicant's Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program consistent with the recommended GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements, and acceptable."

Operating Experience. LRA Section B.2.35 states that the new Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program has no operating experience; however, as noted in the GALL Report, industry operating experience shows that cross-linked polyethylene or high-molecular-weight polyethylene insulation materials are most susceptible to water tree formation. The formation and growth of water trees vary directly with operating voltage; for example, treeing is much less prevalent in 4kV cables than those operated at 13 or 33kV. Finally, minimizing exposure to moisture minimizes the potential for water tree development.

The LRA states that there is no plant-specific operating experience history for the new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. Noting that SRP-LR, Revision 1, Appendix A, Branch Technical Position RLSB-1, states that an applicant may have to submit future operating experience for new programs to confirm their effectiveness, the staff asked the applicant to describe how it would record operating experience to confirm program effectiveness and how it would adjust the program as needed.

In its response dated August 20, 2007, the applicant stated:

> Plant-specific and industry wide operating experience (OE) was considered in the development of the Appendix B electrical programs. Industry operating experience that forms the basis for these Appendix B electrical programs is included in the operating experience element of the corresponding GALL Report Chapter XI Programs. Plant-specific operating experience was reviewed to ensure that the GALL Report

Chapter XI Programs will be effective AMPs for the period of extended operation (PEO). This review is discussed in Calculation HNP-P/LR-0300, Attachment 14. This review confirms that the operating experience discussed in the GALL Report Chapter XI Programs is bounding. Operating experience going forward will be captured through the HNP Corrective Action and Operating Experience Programs implemented in accordance with Progress Energy corporate procedures. This ongoing review of operating experience will continue throughout the PEO and the results will be maintained on site. The Corrective Action and Operating Experience Programs are implemented by the HNP QA Program in accordance with 10 CFR 50, Appendix B. This process will verify that the Appendix B electrical programs continue to be effective in the management of aging effects.

In the same August 20, 2007 letter, the applicant proposed to amend LRA Section B.2.35 to add this information to the "operating experience" program element.

The staff finds the response acceptable because the applicant has considered plant-specific and industry operating experience in the development of this program and has confirmed that the operating experience described in GALL AMP XI.E1 is bounding and that corrective action and operating experience programs implemented in accordance with corporate procedures will record future operating experience.

The staff interviewed the applicant's personnel, reviewed the applicant's calculation and a sample of evaluations of plant-specific and industry operating experience of cables in the program, and confirmed that plant-specific operating experience revealed no aging effects for cables within the scope of this program not bounded by industry operating 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.

FSAR Supplement. In LRA Section A.1.1.35, the applicant provided the FSAR supplement for the Inaccessible Medium-Voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed this section and determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff also confirmed that the applicant's license renewal commitment list shows this new program as Commitment No. 29 to be implemented prior to the period of extended operation.

Conclusion. On the basis of its audit and review of the applicant's Inaccessible Medium-Voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.11 Metal Enclosed Bus Program

Summary of Technical Information in the Application. LRA Section B.2.36 describes the new Metal Enclosed Bus Program as consistent with GALL AMP XI.E4, "Metal Enclosed Bus."

The Metal Enclosed Bus Program is credited for aging management of the isophase bus as well as nonsegregated 6.9 kV and 480 V metal enclosed buses (MEBs) within the scope of license renewal. The program involves various activities conducted at least once every 10-years to identify potential aging degradation. In this AMP a sample of accessible bolted connections will be checked for loose connection by thermography or by connection resistance measurement with a low-range ohmmeter. In addition, internal portions of the bus enclosure will be inspected visually for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of moisture intrusion. The bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration which may indicate overheating or aging degradation. Internal bus supports will be visually inspected for structural integrity and signs of cracking.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the information in LRA Section B.2.36 describing the new Metal Enclosed Bus Program, interviewed the applicant's technical personnel, and reviewed its Metal Enclosed Bus Program basis documents assessing program consistency with GALL AMP XI.E4.

The staff concludes that the applicant's Metal Enclosed Bus Program assures management of aging effects caused by cracked insulation, moisture, debris in the bus enclosure, and loosening of bolted connections consistent with the CLB during the period of extended operation. The staff finds the applicant's Metal Enclosed Bus Program consistent with the recommended GALL AMP XI.E4, "Metal Enclosed Bus," and acceptable.

Operating Experience. LRA Section B.2.36 states that the new Metal Enclosed Bus Program has no plant-specific operating experience. Industry experience shows that failures on MEBs have been caused by cracked insulation and moisture or internal debris buildup and that MEB bus connections exposed to appreciable ohmic heating during operation may experience loosening due to repeated cycling of connected loads.

The LRA states that there is no plant-specific operating experience history for the new Metal Enclosed Bus Program. Noting that SRP-LR, Revision 1, Appendix A, Branch Technical Position RLSB-1, states that an applicant may have to submit future operating experience for new programs to confirm their effectiveness, the staff asked the applicant to describe how it would record operating experience to confirm program effectiveness and how it would adjust the program as needed.

In its response dated August 20, 2007, the applicant stated:

> Plant-specific and industry wide operating experience (OE) was considered in the development of the Appendix B electrical programs. Industry operating experience that forms the basis for these Appendix B electrical programs is included in the operating experience element of the corresponding GALL Report Chapter XI Programs. Plant-specific operating experience was reviewed to ensure that the GALL Report Chapter XI Programs will be effective AMPs for the period of extended operation (PEO). This review is discussed in Calculation HNP-P/LR-0300, Attachment 14. This review confirms that the operating experience discussed in the GALL Report Chapter XI Programs is bounding. Operating experience going forward will be captured through the HNP Corrective Action and Operating Experience Programs implemented in accordance with Progress Energy corporate procedures. This ongoing review of operating experience will continue throughout the PEO and the results will be maintained on site. The Corrective Action and Operating Experience Programs are implemented by the HNP QA Program in accordance with 10 CFR 50, Appendix B. This process will verify that the Appendix B electrical programs continue to be effective in the management of aging effects.

In the same August 20, 2007 letter, the applicant proposed to amend LRA Section B.2.36 to add this information to the "operating experience" program element.

The staff finds the response acceptable because the applicant has considered plant-specific and industry operating experience in the development of this program and has confirmed that the operating experience described in GALL AMP XI.E1 is bounding and that corrective action and operating experience programs implemented in accordance with corporate procedures will record future operating experience.

The staff interviewed the applicant's personnel, reviewed the applicant's calculation and a sample of evaluations of plant-specific and industry operating experience, and confirmed that plant-specific operating experience revealed no aging effects for components within the scope of this program not bounded by industry operating 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.

FSAR Supplement. In LRA Section A.1.1.36, the applicant provided the FSAR supplement for the Metal Enclosed Bus Program. The staff reviewed this section and determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff also confirmed that applicant's license renewal commitment list shows this new program as Commitment No. 30 to be implemented prior to the period of extended operation.

Conclusion. On the basis of its audit and review of the applicant's Metal Enclosed Bus Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. LRA Section B.2.37 describes the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as consistent with GALL AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is credited for aging management of cable connections not included in the Environmental Qualification (EQ) Program. Samplings of cable connections within the scope of license renewal will be tested at least every 10-years for an indication of cable connection integrity. The specific type of test to be determined will be proven (*e.g.*, thermography, contact resistance testing, bridge balance testing) or other appropriate testing for detecting loose connections judged to be effective in determining cable connection integrity. The aging effect or mechanism of concern is loosening of cable connections. The technical basis for the sample selections of cable connections to be tested will be provided. The scope of this sampling program will include electrical cable connections in power and I&C applications as well as connections in areas with corrosive chemicals and in outdoor structures in uncontrolled environments. In addition, the program will include the bolted connections on the overhead transmission conductors from the high-voltage bushings on the main power transformers to the switchyard bus.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the information in LRA Section B.2.37 describing the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, interviewed the applicant's technical personnel, and reviewed the program basis documents, specifically the program elements basis documents, for consistency with GALL AMP XI.E6.

GALL AMP XI.E6 states that an unacceptable condition or situation found in a selected sample requires a determination as to whether the same condition or situation is present in other connections not tested. As the LRA did not refer to this recommendation, the staff asked the applicant to clarify whether it would implement this recommendation for LRA Section B.2.37.

The applicant responded that the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is consistent with GALL AMP XI.E6. If the program finds an unacceptable condition or situation a selected sample, the HNP corrective action program determines whether the same condition or situation is present in other connections not tested. The staff determined that the applicant's response is consistent with the GALL AMP XI.E6 recommendation, included in the applicant's program basis calculation, and acceptable.

The applicant's program basis calculation states that the "scope of the program" and "detection of aging effects" program elements are not consistent with the corresponding GALL AMP XI.E6 program elements; however, the noting that LRA Section B.2.37 states that all elements of this program are consistent with GALL AMP XI.E6, the staff asked the applicant why LRA Section B.2.37 does not state these exceptions and technical justifications for them.

In a letter dated August 20, 2007, the applicant stated that the program basis calculation followed submission of the LRA in 2006. The basis for this revision was the NRC letter dated March 16, 2007, "Staff Response to the Nuclear Energy Institute (NEI) White Paper on Generic Aging Lessons Learned (GALL) Report Aging Management Program (AMP) XI.E6, 'Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirement.'" The applicant stated that it would amend LRA Section B.2.37 to show the following exceptions and their bases:

> Under the program element "scope of the program," GALL AMP XI.E6 states "Connections associated with cables within the scope of license renewal are part of this program, regardless of their association with active or passive components."
>
> Consistent with the clarification provided in the NRC letter, this element of Calculation No. HNP-P/LR-0668 was revised to read "The HNP AMP applies to cables connections within the scope of license renewal not covered under the existing EQ program. The scope of this program includes only external cable connections terminating at an active device such as motor, motor control center, switchgear or of a passive device such as a fuse cabinet. Wiring connections internal to an active assembly installed by manufacturers are considered a part of the active assembly and therefore are not within the scope of this program."
>
> Under the program element "detection of aging effects" GALL AMP XI.E6 states "Electrical connections within the scope of license renewal will be tested at least once every 10 years. Testing may include thermography, contact resistance testing, or other appropriate testing methods. This is an adequate period to preclude failures of the electrical connections since experience has shown that aging degradation is a slow process. A 10-year testing interval will provide two data points during a 20-year period, which can be used to characterize the degradation rate. The first tests for license renewal are to be completed before the period of extended operation."
>
> Consistent with the test frequency flexibility provided in the NRC letter, this element of Calculation No. HNP-P/LR-0668 was revised to read "This program will be implemented as a one-time inspection on a representative sample of non-EQ cable connections within the scope of license renewal prior to the period of extended operation. Inspection methods may include thermography, contact resistance testing, bridge balance testing,

or other appropriate testing methods. This one-time inspection verifies that the loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation is not an aging effect that requires a periodic aging management program."

GALL AMP XI.E6 along with the clarification provided in the NRC letter forms the technical basis and justification for the HNP program described in LRA Section B.2.37.

In the same August 20, 2007 letter, the applicant proposed to amend LRA Section B.2.37 to add this information.

The staff reviewed the applicant's exceptions to the program elements "scope of the program," and "detection of aging effects" and determined that the "scope of the program" exception, which includes only external cable connections terminating at an active device (*e.g.*, motor, motor control center, switchgear) or a passive device (*e.g.*, fuse cabinet) is consistent with the staff's proposed revision to the GALL AMP XI.E6, adequate to manage the potential aging of electrical cable connections not subject to 10 CFR 50.49 EQ requirements, and acceptable.

In addition, the staff determined that the "detection of aging effects" exception, which includes a one-time inspection of a representative sample of non-EQ cable connections within the scope of license renewal prior to the period of extended operation, is consistent with the staff's proposed revision to the GALL AMP XI.E6, adequate to manage the potential aging of electrical cable connections not subject to 10 CFR 50.49 EQ requirements, and acceptable. The staff notes that the applicant will take corrective actions in accordance with the HNP corrective action process when the one-time inspection finds problems. Corrective actions may include but are not limited to sample expansion, increased inspection frequency, and replacement or repair of the affected cable connection components.

<u>Operating Experience</u>. LRA Section B.2.37 states that the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program has no operating experience; however, as noted in the GALL Report, industry operating experience shows that circuits exposed to appreciable ohmic or ambient heating during operation may experience loosening due to repeated cycling of connected loads or to the ambient temperature.

The LRA states that there is no plant-specific operating experience history for the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. Noting that SRP-LR, Revision 1, Appendix A, Branch Technical Position RLSB-1, states that an applicant may have to submit future operating experience for new programs to confirm their effectiveness, the staff asked the applicant to describe how it would record operating experience to confirm the program effectiveness and how it would adjust the program as needed.

In its response dated August 20, 2007, the applicant stated:

> Plant-specific and industry wide operating experience (OE) was considered in the development of the Appendix B electrical programs. Industry operating experience that forms the basis for these Appendix B electrical programs is included in the operating experience element of the corresponding GALL Report Chapter XI Programs. Plant-specific operating experience was reviewed to ensure that the GALL Report Chapter XI Programs will be effective AMPs for the period of extended operation (PEO). This review is discussed in Calculation No. HNP-P/LR-0300, Attachment 14. This review confirms that the operating experience discussed in the GALL Report Chapter XI Programs is bounding. Operating experience going forward will be captured through the HNP Corrective Action and Operating Experience Programs implemented in accordance with Progress Energy corporate procedures. This ongoing review of operating experience will continue throughout the PEO and the results will be maintained on site. The Corrective Action and Operating Experience Programs are implemented by the HNP QA Program in accordance with 10 CFR 50, Appendix B. This process will verify that the Appendix B electrical programs continue to be effective in the management of aging effects.

In the same August 20, 2007 letter, the applicant proposed to amend LRA Section B.2.37 to add this information to the "operating experience" program element.

The staff finds the applicant's response acceptable because the applicant has considered plant-specific and industry wide operating experience in the development of this program and has confirmed that the operating experience described in GALL AMP XI.E6 is bounding and that corrective action and operating experience programs implemented in accordance with corporate procedures will record future operating experience.

The staff interviewed the applicant's personnel, reviewed the applicant's calculation and a sample of applicant's evaluations of plant-specific and industry operating experience, and confirmed that plant-specific operating experience revealed no aging effects for components within the scope of this program not bounded by industry operating 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.

FSAR Supplement. In LRA Section A.1.1.37, the applicant provided the FSAR supplement for the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed this section and determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff also confirmed that the applicant's license renewal commitment list shows this new program as Commitment No. 31 to be implemented prior to the period of extended operation.

Conclusion. On the basis of its audit and review of the applicant's Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, 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 it is credited. 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.13 Environmental Qualification (EQ) Program

Summary of Technical Information in the Application. LRA Section B.3.2 describes the existing Environmental Qualification (EQ) Program as consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

The Environmental Qualification (EQ) Program manages component thermal, radiation, and cyclical aging by evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term must be refurbished or replaced or their qualification must be extended before the aging limits established in the evaluation. Aging evaluations for EQ components that specify a qualification of at least 40-years are time-limited aging analyses (TLAAs) for license renewal.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the information in LRA Section B.3.2 describing the existing EQ Program, interviewed the applicant's technical personnel, and reviewed the applicant's program basis documents, specifically, the program elements basis documents, for consistency with GALL AMP X.E1.

The staff noted that the GALL AMP X.E1 program description states that important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). During the audit and review, the staff asked the applicant why LRA Section B.3.2 does not address these attributes as recommended in GALL AMP X.E1. In response, the applicant stated that LRA Sections 4.4.1 and 4.4.2 address these attributes. The staff reviewed those LRA sections and the program basis calculation and determined that the applicant's description of the EQ component reanalysis attributes as specified in GALL AMP X.E1 is adequate and acceptable.

The staff noted that the program basis calculation states that the EQ program conforms to RG 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants," Revision 0, not Revision 1; however, GALL AMP X.E1 recommends RG 1.89, Revision 1, as regulatory guidance for compliance with 10 CFR 50.49. During the audit and review, the staff asked the applicant why LRA Section B.3.2 program elements "parameters monitored or inspected" and "scope of the program" do not state this exception and its technical basis. In response, the applicant stated that the Environmental Qualification (EQ) Program's licensing basis is RG 1.89, Revision 0, an exception to GALL AMP X.E1, which recommends RG 1.89, Revision 1, and that the original program licensing basis is not RG 1.89, Revision 1. HNP was licensed originally as a NUREG-0588, Category II plant, and IEEE Standard 323-1971 was the original EQ program basis. RG 1.89, Revision 1, had not been issued when the HNP construction permit SER was issued. Currently, the EQ program meets 10 CFR 50.49 requirements for electrical components important to safety. The applicant also stated that it will amend LRA Section B 3.2 to state this exception to GALL AMP X.E1.

In a letter dated August 20, 2007, the applicant amended LRA Section B.3.2 to state an exception to the "parameters monitored or inspected" and "scope of the program" program elements. The staff determined that this exception is acceptable because the applicant meets 10 CFR 50.49 requirements by implementing the program in accordance with NUREG-0588 guidance, which is consistent with the staff's review guidance in SRP-LR Section 4.4.1.1.2 (which states that the qualification of safety-related electric equipment in accordance with NUREG-0588, Category II, will be reviewed for the period of extended operation to assess the validity of the extended qualification).

On the basis of its review, the staff concludes that the applicant's EQ Program reasonably assures management of thermal, radiation, and cyclical aging effects for safety-related electrical equipment in harsh environments. The staff finds the applicant's Environmental Qualification Program consistent with recommended GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components, and acceptable."

Operating Experience. LRA Section B.3.2 states that the EQ Program has managed aging effects effectively. As stated in the GALL Report, EQ programs consider operating experience to modify qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform intended functions during accident conditions despite the effects of in-service aging. The excellent operating experience of the systems and components in the program demonstrates its overall effectiveness. Administrative controls continue to require periodic formal internal and external assessments of the Environmental Qualification (EQ) Program by knowledgeable personnel from outside the site EQ group to affect continuous improvement.

The staff reviewed the operating experience in the LRA and interviewed the applicant's technical personnel to confirm whether this program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10.

In reviewing examples of applicant's operating experience evaluations, the staff noted that the EQ Program continuously monitors the qualification basis for all EQ equipment, including aging effects and their impact on equipment qualified life.

For example, the applicant developed a plant change request to evaluate the EQ impact on containment temperature data of 11 resistance temperature detectors installed by a temporary modification to determine actual containment temperatures. As a result of the request, re-calculation of 12 EQ documentation packages ensured that component qualified lives were met.

Another plant change request evaluated the main steam tunnel qualified life calculations based on outdoor temperature. A higher outdoor temperature ultimately changed the technical specification/FSAR by raising the main steam tunnel ambient temperature. The plant change request revised all EQ documentation impacted by the technical specification/FSAR change.

These examples illustrate the applicant's actions to maintain component EQ in accordance with10 CFR 50.49 and its EQ Program has been effective at managing aging effects. The staff also reviewed a corrective action report of industry operating experience with slow stroke time of solenoid operated valves. As a result of this report, the applicant revised the EQ documentation package for two solenoid operated valves to reflect the accurate service life energization time of these EQ components. This incident is an example of EQ Program reaction to operating experience to assure continued equipment EQ.

In reviewing a recent self-assessment report, the staff noted a variety of improvement opportunities but no issues or findings impacting EQ program effectiveness.

Based on its review, the staff concluded that the corrective action program, which records plant-specific and industry operating experience issues, will review and incorporate operating experience for objective evidence of adequate management of aging effects.
On the basis of its review of the operating experience and discussions with the applicant's technical personnel, the staff concludes that the applicant's Environmental Qualification (EQ) Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.39, the applicant provided the FSAR supplement for the Environmental Qualification (EQ) Program. The staff reviewed this section and determines that the information in the FSAR 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 EQ Program, the staff finds all program elements consistent with the GALL Report. 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 FSAR 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 AMPs Consistent with the GALL Report with Exceptions or Enhancements

In LRA Appendix B, the applicant stated that the following AMPs are, or will be, consistent with the GALL Report, with exceptions or enhancements:

- ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Reactor Head Closure Studs Program
- Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure of Pressurized Water Reactors Program
- Flow-Accelerated Corrosion Program
- Bolting Integrity Program
- Steam Generator Tube Integrity Program
- Closed-Cycle Cooling Water System Program
- Boraflex Monitoring Program
- Inspection of Overhead Heavy Load and Light Load Handling Systems Program
- Fire Protection Program
- Fire Water System Program
- Fuel Oil Chemistry Program
- Reactor Vessel Surveillance Program
- Selective Leaching of Materials Program
- One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program
- External Surfaces Monitoring Program
- Flux Thimble Tube Inspection Program
- Lubricating Oil Analysis Program
- ASME Section XI, Subsection IWE Program
- ASME Section XI, Subsection IWL Program
- ASME Section XI, Subsection IWF Program
- 10 CFR Part 50, Appendix J Program
- Masonry Wall Program
- Structures Monitoring Program
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program
- Reactor Coolant Pressure Boundary Fatigue Monitoring Program

For AMPs that the applicant claimed are consistent with the GALL Report, with exception(s) and/or enhancement(s), the staff performed an audit and review to confirm that those attributes or features of the program for which the applicant claimed consistency were indeed consistent. The staff also reviewed the exception(s) and/or enhancement(s) to the GALL Report to determine whether they were acceptable and adequate. The results of the staff's audits and reviews are documented in the following sections.

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

Summary of Technical Information in the Application. LRA Section B.2.1 describes the existing ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program as consistent, with exception, with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program consists of periodic volumetric, surface, and/or visual examination and leakage testing of Classes 1, 2, and 3 pressure-retaining components and their attachments to detect component degradation and determine appropriate corrective actions. The program for the second 10-year interval was developed to meet ASME Code Section XI, 1989 Edition (no addenda) standards.

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 the LRA credits it.

The staff interviewed the applicant's technical personnel and reviewed supporting bases documents, procedures, reports, and calculations for the ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program, including the license renewal basis calculation, the applicant's 10-year inservice inspection (ISI) plan, and the applicant's administrative control procedures for implementing the ISI plan. Specifically, the staff reviewed the program description and the program elements and bases in the license renewal basis calculation for whether the program elements are consistent with the corresponding program elements of GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

The staff noted that the license renewal basis calculation for this AMP establishes how it compares to program elements in GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and states the bases for any exception to the GALL AMP. The staff determined that the applicant's 10-year ISI plan governs specific ISI examinations and activities required for the current 10-year ISI interval and that the ISI plan (1) establishes which plant systems and components are within the scope of 10 CFR 50.55a and ASME Code Section XI, (2) defines the ASME Code classifications for systems and components within the scope of the ISI plan, (3) establishes visual examinations and non-destructive examination inspections (including surface and volumetric examinations) for these systems and components during the 10-Year ISI Interval in effect, and (4) establishes for ASME Code Class systems and components augmented inspections that go beyond examinations required by ASME Code Section XI.

The staff also noted that the applicant's administrative control procedures for the ISI plan define the administrative controls and activities for implementation of the ASME Section XI, Subsections IWB, IWC and IWD Inservice Inspection Program and the ISI plan in accordance with 10 CFR 50.55a and ASME Code Section XI requirements.

Based on this assessment, the staff finds that the applicant's ASME Section XI, Subsections IWB, IWC and IWD Inservice Inspection Program assures for the period of extended operation adequate management of the effects of aging on ASME Code Classes 1, 2, and 3 components for which the LRA credits it with the following exception.

Exception. The LRA states an exception to the GALL Report program element "parameters monitored/inspected," specifically:

> NUREG-1801, XI.M1 describes the ASME Section XI, Subsections IWB, IWC, and IWD, Inservice Inspection Program as conforming to the requirements of the ASME Code, Section XI, Subsections IWB, IWC and IWD, in the 2001 edition including the 2002 and 2003 Addenda. However, as noted in the description of the NUREG-1801 Section XI.M1 program, 10 CFR 50.55a governs the application of Codes and Standards. In conformance with 10 CFR 50.55a(g)(4)(ii), the ISI Program is updated during each successive 120-month inspection interval to comply with the requirements of the latest edition and addenda of the Code specified twelve months before the start of the inspection interval. The difference between the HNP Code of record and the Code edition specified in NUREG-1801is considered to be an exception to NUREG-1801 criteria.

Section 50.55a governs the application and implementation of required codes and standards, including ASME Code Section XI. Paragraph (g)(4)(ii) of 10 CFR 50.55a requires an update of the ASME Code Section XI edition of record for an applicant's ISI Program to the most recent code edition endorsed in the rule at least twelve months prior to the next successive 10-year (*i.e.*,120-month) ISI interval. The difference between the HNP code of record and the code edition specified in GALL Report is an exception to GALL Report criteria.

The staff noted that, at the time of the LRA submission, HNP was in its second 10-Year ISI interval. Its ASME Code Section XI edition of record for that interval was the 1989 Edition with no addenda. The staff's review of the license renewal basis calculation indicated also that on May 2, 2007, HNP entered its third 10-year ISI interval, for which the ASME Code Section XI edition of record is the 2001 Edition with 2003 Addenda. GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," refers to this edition.

The applicant has updated its ASME Code Section XI edition of record to the 2001 Edition of the ASME Code Section XI with 2003 Addenda, the same edition recommended for implementation in GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The staff concludes that the exception to GALL AMP XI.M1 is no longer part of the review of this AMP. Instead, the program elements of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program are consistent with the GALL AMP XI.M1 program elements and acceptable.

Operating Experience. LRA Section B.2.1 states that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program is implemented and maintained in accordance with general requirements for engineering programs for assurance that the program effectively meets regulatory and procedural requirements, including periodic reviews. Qualified personnel assigned as program managers have authority and responsibility to implement the program and commit adequate resources to program activities.

The applicant stated that the condition reports and ISI history, including self-assessments and inspections, showed the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program has been effective, continually improving and shows evidence that program practices ensure the continued integrity of ISI Classes 1, 2, and 3 components.

The staff reviewed HNP's 10-Year ISI Plan and related documents to assess whether the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program factored industry experience into its scope. The staff focused particularly on whether the program provides for augmented ISI examinations of ASME Code Class 1 components made from nickel-based alloys (including Inconel alloys, Alloy 600 and Alloy 690 base metal materials, and Alloy 82, 182, 52,and 152 weld filler metal materials). The staff based this review on the following NRC generic communications:

- NRC Order EA-03-009 and its first revision (collectively NRC Order EA-03-009): This order states NRC augmented ISI requirements for upper reactor pressure vessel head (RPVH) penetration nozzles and their nickel-alloy welds in PWRs

- NRC Bulletin 2003-02: This bulletin states NRC augmented inspection recommendations for lower RPVH nozzles and their nickel alloy welds in PWRs

- NRC Bulletin 2004-01: This bulletin states NRC augmented inspection recommendations for nickel alloy components and nickel alloy weld materials in PWR pressurizers

The operating experience summarized in these documents shows that cracking of nickel alloy base metal and weld components is a safety issue requiring management for PWR facilities.

The applicant's response dated February 26, 2003, consented to the augmented inspection requirements established for upper RPVH penetration nozzles in NRC Order EA-03-2009. The staff's review of the 10-Year ISI Plan indicates that this AMP requires augmented inspections of the upper RPVH penetration nozzles and welds. Augmented inspections are also within the scope of the applicant's Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads Program of Pressurized Water Reactors Program (LRA AMP B.2.5). The staff evaluates the ability of the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads Program to manage age-related degradation in the upper reactor pressure vessel head penetration nozzles in SER Section 3.0.3.2.3.

The applicant's response dated November 13, 2003, to Bulletin 2003-02 committed to perform augmented bare metal visual (BMV) examinations of its lower RPVH penetration nozzle welds during Refueling Outage (RFO) 12 (Fall 2004). In reviewing the 10-Year ISI Plan the staff noted that the applicant had completed the BMV examinations of the lower RPVH penetration nozzles per its commitment in the letter of November 13, 2003, addressing the NRC Bulletin 2003-02 recommendations and had found no signs of reactor coolant leakage from the lower RPVH penetrations.

The applicant's response dated July 27, 2004, to Bulletin 2004-01 committed to perform augmented BMV examinations of nickel-alloy components in its pressurizer during RFO-12 (Fall 2004) and every subsequent RFO for mitigation. Additional guidance will come from the EPRI Materials Reliability Program or new ASME Code Section XI or NRC requirements imposed for these components. The staff reviewed the 10-Year ISI Plan and noted that the applicant has implemented the BMV examinations of its nickel alloy pressurizer components per its commitment in the letter of July 27, 2004. The 10-Year ISI Plan also demonstrated that the BMV examinations have found no signs of reactor coolant leakage in the nickel alloy pressurizer components.

Based on this review, the staff finds that the applicant has an acceptable process for augmentation of its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program based on 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.

FSAR Supplement. In LRA Section A.1.1.1, the applicant provided the FSAR supplement for the ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff reviewed this section and determines that the information in the FSAR 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 ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD 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 justifications and determines that the AMP 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. LRA Section B.2.3 describes the existing Reactor Head Closure Studs Program as consistent, with exception, with GALL AMP XI.M3, "Reactor Head Closure Studs."

The applicant stated that the Reactor Head Closure Studs Program manages cracking and loss of material for the Reactor Vessel Closure Head Stud Assembly by inspection. In addition to its condition monitoring elements, the Reactor Head Closure Studs Program has certain preventive measures recommended by RG 1.65, "Material and Inspection for Reactor Vessel Closure Studs." This AMP is implemented primarily through the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program without the need for program enhancements. The closure head stud assembly comprises the studs and nuts inspected under the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The inspection schedule is in accordance with ASME Boiler & Pressure Vessel Code Section XI, IWB-2400, and the extent and frequency are in accordance with Table IWB-2500-1, Examination Category B-G-1 to ensure detection and repair of aging effects before loss of intended function. Examination results are evaluated according to IWB-3100. Acceptance standards are shown in IWB-3400 and IWB-3500. In addition to the examinations under the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, the Reactor Head Closure Studs Program credits code-required visual VT-2 examinations to detect leaks during system pressure or function tests. Repair and replacement are in conformance with the requirements of IWB-4000 and IWB-7000 respectively. The Reactor Head Closure Studs Program inspections provide reasonable assurance that the effects of cracking and loss of material would be detected prior to loss of intended function. The preventive measures include use of a manganese base phosphate coating and no use of metal-plated stud bolting.

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 the LRA credits it.

The staff interviewed the applicant's technical personnel and reviewed supporting bases documents, procedures, reports, and calculations for the Reactor Head Closure Studs Program, including the applicant's license renewal basis document in Calculation HNP-P/LR-0619, Revision 1, "License Renewal Aging Management Program Description of the Reactor Head Closure Studs Program" (October 19, 2006), NRC guidelines in Regulatory Guide 1.65, "Materials and Inspections of Reactor Vessel Closure Studs," Progress Energy Procedure No. ISI-100, "Control of Inservice Inspection and Testing Activities," and Progress Energy Procedure HNP-ISI-002, Revision 1, "HNP ISI Program Plan - 2nd Interval" (May 4, 2005).

The license renewal basis calculation indicates that the applicant implements its Reactor Head Closure Studs Program in accordance with Section 50.55a, ASME Code Section XI, Examination Category B-G-1, and the guidelines of NRC RG 1.65. The specific details of the examinations required for reactor head closure assembly components are in Inspection Items B6.10, B6.20, B6.30, B6.40, and B6.50 for Examination Category B-G-1 and in cover examination requirements for the reactor head closure nuts, reactor head closure studs (both when in place and when removed), threads in the reactor head closure flange, and reactor head closure washers and bushings. The inspection items require a combination of visual and surface or volumetric examinations to monitor for any loss of material or cracking in the reactor head closure stud assembly components. The staff determined that this requirement is consistent with the recommended program elements of GALL AMP XI.M3, "Reactor Head Closure Studs," with the following exception. The staff evaluates the acceptability of the applicant's exception to GALL AMP XI.M3, "Reactor Head Closure Studs," in the following section.

Exception. The LRA states an exception to the GALL Report program element "parameters monitored/inspected," specifically:

> NUREG-1801, Section XI.M3, describes the Reactor Head Closure Studs Aging Management Program as conforming to the requirements of the ASME Code, Section XI, Subsection IWB, 2001 edition, including the 2002 and 2003 Addenda, Table IWB 2500-1. However, as noted in the description of the NUREG-1801, Section XI.M1, program, 10 CFR 50.55a governs the application of Codes and Standards. In conformance with 10 CFR50.55a(g)(4)(ii), the ISI Program is updated during each successive 120-month inspection interval to comply with the requirements of the latest edition and addenda of the Code specified twelve months before the start of the inspection interval. The difference between the HNP Code of record and the Code edition specified in NUREG-1801 is considered to be an exception to NUREG-1801 criteria.

Section 10 CFR 50.55a governs the application and implementation of required codes and standards, including ASME Code Section XI. Paragraph (g)(4)(ii) of 10 CFR 50.55a requires an update of the ASME Code Section XI edition of record for an applicant's ISI Program to the most recent code edition endorsed in rule at least twelve months prior to the next successive 10-year (*i.e.*,120-month) ISI interval.

At the time of the LRA submission, HNP was in its second 10-Year ISI Interval. The staff noted that the ASME Code Section XI edition of record for that interval was the 1989 Edition of the ASME Code Section XI with no addenda. In reviewing the license renewal basis calculation, the staff noted that on May 2, 2007, HNP entered its third 10-year ISI interval, for which the ASME Code Section XI edition of record is the 2001 Edition with 2003 Addenda. GALL AMP XI.M1 refers to this edition.

The applicant has updated its ASME Code Section XI edition of record to the 2001 Edition of the ASME Code Section XI with 2003 Addenda, the same edition recommended for implementation in GALL AMP XI.M3, "Reactor Head Closure Studs." The staff concludes that the exception to GALL AMP XI.M1 is no longer part of the review of this AMP. Instead, the program elements of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program are consistent with the GALL AMP XI.M3, "Reactor Head Closure Studs," program elements and acceptable.

Operating Experience. LRA Section B.2.3 states that there have been no aging effects identified for the reactor vessel closure head stud assembly; therefore, operating experience cannot show program effectiveness.

As the GALL Report states, industry operating experience includes cracking in boiling-water reactor pressure vessel head studs. The GALL Report is based on industry operating experience through January 2005. The applicant's review of recent industry operating experience revealed no additional reactor head closure stud degradation. The LRA and the license renewal basis calculation indicate that HNP will review any new industry operating experience with reactor head closure stud degradation through the period of extended operation.

The staff interviewed the applicant's staff during the license renewal audit. The staff noted the license renewal basis document for this AMP showed no plant-specific operating experience with reactor closure head assembly components but cracking of reactor head closure studs at Dresden Unit 2 as industry operating experience for this AMP. The staff confirmed that there is no plant-specific age-related operating experience for the reactor head closure assembly components.

As noted in the staff's evaluation of the exception for this AMP, the applicant's ISI examinations under ASME Code Section XI, Examination B-G-1 for the reactor head closure assembly components can detect loss of material and cracking. Based on this review, the staff concludes that the applicant has addressed industry operating experience relevant to the Reactor Head Closure Studs Program and that the scope of this AMP includes inspection techniques that can detect the aging effects shown by industry operating experience. The staff concludes that the "operating experience" element for the Reactor Head Closure Studs Program is 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.

FSAR Supplement. In LRA Section A.1.1.3, the applicant provided the FSAR supplement for the Reactor Head Closure Studs Program. The staff reviewed this section and determines that the information in the FSAR 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 Reactor Head Closure Studs 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 justifications 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 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure of Pressurized Water Reactors Program

Summary of Technical Information in the Application. LRA Section B.2.5 describes the existing Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure of Pressurized Water Reactors Program as consistent, with enhancement, with GALL AMP XI.M11A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors."

The applicant stated that since the issuance of GL 97-01, the applicant has participated actively in industry initiatives on Alloy 600 and the specific issue of degradation of vessel head penetration (VHP) nozzles. Since GL 97-01, additional operating experience shows occurrences of circumferential cracking in VHP nozzles resulting in the issuance of NRC Bulletin 2001-01, which required evaluation of VHP nozzles for susceptibility. The applicant's response was supported by the PWR [pressurized-water reactor] Materials Reliability Program Response to Bulletin 2001-01 (MRP-48), which categorized HNP as a "low"-susceptibility plant. Subsequently, Bulletins 2002-01 and 2002-02 were issued as results of several cracked and leaking Alloy 600 VHP nozzles within the industry including the degradation of the reactor pressure vessel head at Davis-Besse. In response to the NRC bulletins, the applicant provided additional assurance that its programs are adequate to prevent degradation as observed in the industry. Additionally, in response to Bulletin 2002-02, the applicant proactively scheduled and completed a 100 percent BMV inspection of the reactor pressure vessel head and control rod drive mechanism penetrations.

The applicant also stated that on February 11, 2003, NRC Order EA-03-009 established interim inspection requirements for reactor pressure vessel heads at PWRs. Subsequently, the NRC issued First Revised Order EA-03-009 on February 20, 2004, to revise certain inspection aspects of the original order. The order (as revised) resulted in major changes to the applicant's program for managing cracking in the VHP nozzles. The revised order required determination of a susceptibility ranking and inspections commensurate with plant susceptibility rankings. The revised order required from HNP, as a "low" susceptibility plant, a 100 percent BMV inspection of the reactor pressure vessel head surface (including 360 ° around each penetration nozzle) to be completed at least every third RFO or every five years, whichever comes first. In keeping with the revised order, the applicant completed the BMV inspection during RFO-11. This inspection was observed as a part of a staff integrated inspection. The applicant calculates the susceptibility ranking using the technical method described in the revised order. The applicant updates this susceptibility calculation periodically to incorporate actual operating plant data for each completed plant cycle. The calculation currently projects a "low" susceptibility ranking well into the period of extended operation.

The applicant further stated that following industry initiative, NEI 03-08, "Guideline for the Management of Materials Issues," and as mandated by EPRI Materials Reliability Program (MRP)-126, "Generic Guidance for Alloy 600 Management," the applicant committed to develop and document an Alloy 600 management plan. On June 21, 2006, the applicant issued Revision 0 of the corporate " °Alloy 600 Strategic Plan." Issuance of this document establishes compliance with the NEI 03-08 mandate to implement the requirements of MRP-126. This plan will define the processes the applicant intends to use to maintain the integrity and operability of each Alloy 600/82/182 component for the remaining life of the plant. The Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program is implemented through the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program by augmented 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, remained adequate to manage the aging effects for which the LRA credits it.

During the audit, the staff interviewed the applicant's technical personnel and reviewed documents on the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program, including the license renewal program evaluation report (Calculation No. HNP-P/LR-0607, Revision 1, dated June 6, 2006), assessing consistency of the program elements with those of GALL AMP XI.M11A.

Revised Order EA-03-009, Section IV.C.(3), for plants in the low category requires BMV examinations meeting Section IV.C.(5)(a) requirements every third RFO or every five years and nonvisual NDEs (ultrasonic, eddy current/dye penetrant testing, or a combination these examinations) at least every fourth RFO or every seven years, whichever occurs first.

The staff noted that the LRA program description of this AMP states that HNP completed the BMV inspection during RFO-11, and the calculation projects a low susceptibility ranking into the period of extended operation; however, the operating experience description states no additional information for the BMV examination results nor whether HNP had completed or scheduled nonvisual NDEs. The staff requested that the applicant:

- State the BMV examination results and explain how they meet Revised Order EA-03-009 requirements

- Calculate the HNP effective degradation years for the completed plant cycles and for the period of extended operation

- Clarify whether nonvisual NDEs have occurred during the previous RFOs and, if so, whether results meet Revised Order EA-03-009 requirements

In response to the staff's request, the applicant stated that:

- The order requires a 100-percent BMV examination of the reactor pressure vessel (RPV) head surface. Such an examination during RFO-11 revealed no evidence of leakage. HNP made a detailed inspection report to the NRC within 60 days as required by the order. The next BMV examination will proceed in RFO-14 scheduled in the Fall of 2007 in accordance with the order.

- The actual calculation of effective degradation years through Cycle 12 is 2.521. Although HNP has completed 13 plant cycles, the calculation through Cycle 13 is not yet complete; however, the projected calculation through Cycle 13 is 2.76. The period of extended operation begins during Cycle 27. The projection through Cycle 27 into the period of extended operation is 6.16 ("low" category). The category should remain "low" through operating Cycle 34. Beginning with Cycle 35, the projected category is "moderate" (more than eight effective degradation years) through Cycle 40 (60 years of operation). The projected calculation through Cycle 40 is 9.34. HNP will characterize the susceptibility category to "moderate" or "high" as appropriate in accordance with the order and inspections and examinations will proceed as required.

- During RFO-13, HNP examined the reactor vessel head penetrations using nonvisual NDEs to satisfy Order Section IV.C.(5)(b) requirements and to set a baseline for future examinations. These examinations found no evidence of primary water stress corrosion cracking. HNP made a detailed inspection report to the NRC within 60 days as required by the order.

The staff reviewed implementation procedures and inspections reports and interviewed the applicant's technical personnel with specialized knowledge of the program and found no omissions of NRC Order EA-03-009 requirements or GALL AMP XI.M11A recommendations. On this basis, the staff found that the applicant's implementation of the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program is acceptable.

Enhancement. The LRA states an enhancement to the GALL Report program element "parameters monitored or inspected," specifically:

> The Inservice Inspection Program procedure will be enhanced to include the augmented inspections required by NRC Order EA-03-009 (as amended).

The applicant in Enclosure 1 to its letter dated November 14, 2006 committed (Commitment No. 3) to implement the enhancement prior to the period of the extended operation.

During the audit, the staff requested from the applicant additional information on the augmented inspections to be included in the enhancement to the Inservice Inspection (ISI) Program procedure.

The applicant responded that the procedure administers the Inservice Inspection (ISI) Program by designating augmented inspection programs under the ISI program. All inspections as required by NRC Order EA-03-009 will be augmented inspections under the ISI program. This enhancement clarified the program procedure to designate inspections required by NRC Order EA-03-009 as "augmented inspections" under the Inservice Inspection (ISI) Program.

The staff reviewed the ISI program procedure (ISI-100, "Control of Inservice and Testing Activities, Revision 26, dated April 4, 2007) and noted that this enhanced procedure includes augmented inspections required by NRC Order EA-03-009. The enhanced procedure specifically states that it is required to implement license renewal commitments and requirements in support of the Nickel-Alloy Penetration Nozzle Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program. On the basis of this review, the staff finds the applicant's proposed enhancement acceptable.

Operating Experience. LRA Section B.2.5 states that, although no VHP nozzle cracking has been detected, the applicant has participated actively in the industry response to the issue by a commitment to implement a plant-specific Alloy 600 Management Plan as described in MRP-126, "Materials Reliability Program Generic Guidance for Alloy 600 Management," Final Report, November 2004. This plan will be based upon industry Alloy 600/82/182 operating experience and will schedule periodic reviews of industry data on inspection, repair, mitigation technologies, and lessons learned from industry experience.

The staff reviewed the operating experience described in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience. During the audit, the staff noted that the applicant recently had completed both a BMV examination of the top of the reactor vessel closure head and a nonvisual NDE of the nickel-alloy penetration nozzles of the reactor vessel closure head. The staff reviewed the implementing procedures for these examinations and asked the applicant for a summary of examination results.

The applicant's response to the staff's request stated that HNP had completed a 100-percent BMV examination of the reactor pressure vessel head surface during RFO-11 with no evidence of leakage revealed. The applicant added that the next BMV examination will proceed in the Fall of 2007 (RFO-14). The applicant's response also stated that, during RFO-13, nonvisual NDEs of the vessel head penetrations found no evidence of primary water stress corrosion cracking. The staff reviewed the applicant's letters dated July 16, 2003, and July 14, 2006, submitting BMV and NDE inspection reports for the reactor vessel head and found the applicant's response consistent with the submitted reports. Based on the applicant's compliance with NRC Order EA-03-009, the staff finds the "operating experience" program element acceptable.

FSAR Supplement. In LRA Section A.1.1.5, the applicant provided the FSAR supplement for the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure of Pressurized Water Reactors Program. Further, in Enclosure 1 of its letter dated November 14, 2006, the applicant committed (Commitment No. 3) to enhance the ISI program administrative control prior to the period of extended operation. The staff reviewed this commitment and LRA Section A.1.1.5 and determines that the information in the FSAR 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 Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure of Pressurized Water Reactors Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that their implementation 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. LRA Section B.2.7 describes the existing Flow-Accelerated Corrosion Program as consistent, with enhancement, with GALL AMP XI.M17, "Flow-Accelerated Corrosion."

The applicant stated that the Flow-Accelerated Corrosion Program predicts, detects, and monitors flow-accelerated corrosion (FAC) in piping and piping components so timely and appropriate action may minimize the probability of a FAC-induced leak or rupture. The Flow-Accelerated Corrosion Program is based on the guidance of EPRI NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program," and includes an analysis to determine critical locations, limited baseline inspections to determine the extent of thinning at these locations, follow-up inspections to confirm the predictions, and repair or replacement of components as necessary.

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, remained adequate to manage the aging effects for which the LRA credits it.

The applicant defines its existing, inspection-based Flow-Accelerated Corrosion Program when enhanced as consistent with the ten program elements of GALL AMP XI.M17, "Flow-Accelerated Corrosion." During the audit, the staff reviewed the Flow-Accelerated Corrosion Program license renewal basis calculation, the basis document establishing how the program elements compare to the ten program elements of GALL AMP XI.M17.

NRC Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants" (November 6, 1987), and NRC Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning" (May 2, 1989), state the NRC bases for FAC programs at US nuclear power plants. The staff reviewed the license renewal basis document and noted that the scope of Flow-Accelerated Corrosion Program includes these generic communications and the applicant's responses dated September 14, 1987, to Bulletin 87-01 and July 21, 1989, to Generic Letter 89-08. The staff also noted that the scope of the Flow-Accelerated Corrosion Program includes the implementation guidelines of EPRI Report No. NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program" (April 1999). The applicant's inclusion of these documents into the scope of the Flow-Accelerated Corrosion Program is consistent with the recommendations of the "scope of program" element of GALL AMP XI.M17, "Flow-Accelerated Corrosion," and acceptable.

The staff reviewed the license renewal basis calculation and noted that the Flow-Accelerated Corrosion Program monitors for loss of material due to corrosion in carbon steel piping components and alloy steel components with less than 1 percent chromium as an alloy element. This monitoring is consistent with the "parameters inspected/monitored" program element of GALL AMP XI.M17, "Flow-Accelerated Corrosion," and acceptable.
The staff also reviewed the implementation procedure for the Flow-Accelerated Corrosion Program and noted that the procedure invokes the implementation guidelines of EPRI Report No. NSAC-202L-R2 and also administratively requires the applicant to model and rank the

susceptibility of its carbon steel and low-alloy steel piping components as well as to schedule and implement ultrasonic testing (UT) examinations in accordance with the CHECWORKS computer code. This requirement includes incorporating the results of previous UT examinations into the CHECWORKS modeling software and using them to re-establish piping rankings to determine and schedule locations that need UT inspection at the next inspection period. The procedure is consistent with the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of GALL AMP XI.M17, "Flow-Accelerated Corrosion," and acceptable.

The staff's evaluation of the applicant's program enhancement for this program follows:

Enhancement. The LRA states an enhancement to the"scope of program" program element of GALL AMP XI.M17, "Flow-Accelerated Corrosion," specifically:

> The HNP FAC Program will be enhanced to provide a consolidated exclusion bases document (i.e., a FAC susceptibility analysis). The exclusion basis document will include an evaluation of the Steam Generator Feedwater Nozzles to determine their susceptibility to FAC.

The staff's review of the license renewal basis calculation indicated that EPRI Report No. NSAC-202L-R2 sets screening criteria for excluding plant piping components and that the applicant's Flow-Accelerated Corrosion Program uses these EPRI criteria; however, the applicant has not proceduralized these exclusion criteria into a corporate or plant-specific exclusion criteria bases document. The applicant therefore included the need to proceduralize these exclusion criteria (*i.e.*, develop an exclusion bases document) as a necessary program enhancement. Use of these exclusion criteria is acceptable because GALL AMP XI.MM17, "Flow-Accelerated Corrosion," refers to EPRI Report No. NSAC-202L-R2 as acceptable guidance for FAC programs and because the EPRI guidelines are acceptable criteria for including or excluding plant systems. The staff has confirmed that this part of the enhancement is in Commitment No. 5 submitted in the applicant's letter of November 14, 2006.

The applicant's enhancement also provides in the exclusion bases document for an evaluation of the steam generator feedwater nozzles to determine their susceptibility to FAC. The staff also confirmed that this part of the enhancement is in Commitment No. 5. The staff found this provision acceptable because the screening criteria are consistent with recommendations of GALL AMP XI.M17, "Flow-Accelerated Corrosion," and the applicant will use these EPRI Report No. NSAC-202L-R2 criteria to determine whether the steam generator feedwater nozzles should be included in the scope of the Flow-Accelerated Corrosion Program.

The applicant's enhancement of the Flow-Accelerated Corrosion Program is Commitment No. 5. Based on this review, the staff concludes that the Flow-Accelerated Corrosion Program, when enhanced by Commitment No. 5, will be consistent with the program elements of GALL AMP XI.M17, "Flow-Accelerated Corrosion," and acceptable.

Operating Experience. LRA Section B.2.7 states that nuclear power plants have experienced pipe wall thinning largely attributable to FAC in single-phase and two-phase high-energy piping systems. In response to Generic Letter 89-08, the industry has mounted a broad-based effort to manage this aging mechanism, previously referred to as "erosion-corrosion." HNP has experienced through-wall leakage in high-energy carbon steel piping; however, there have been no catastrophic failures and the number of instances of through-wall failures has declined steadily.

The applicant stated that the Flow-Accelerated Corrosion Program, as evolved through industry experience, is described in NSAC-202L-R2. The Flow-Accelerated Corrosion Program has been effective in its response to both industry and plant-specific operating experience and effectively ensures the structural integrity of high-energy carbon steel systems. Since inception, the Flow-Accelerated Corrosion Program has matured and become more effective as a result of program improvements based upon self-assessments, independent staff inspections, and plant-specific and industry operating experience.

The staff has audited industry programs based on the EPRI methodology at several plants and determined that these activities are good predictors of FAC onset so timely corrective actions can be undertaken.

During the audit, the staff interviewed the applicant's staff responsible for implementing the Flow-Accelerated Corrosion Program. The license renewal basis calculation for the Flow-Accelerated Corrosion Program indicated that review of both industry and plant-specific operating experience is an ongoing part of the Flow-Accelerated Corrosion Program, that this review will extend through the period of extended operation, and that the incorporation of operating experience into the Flow-Accelerated Corrosion Program is also a programmatic requirement invoked by corporate procedures. The applicant clarified that its reviews of industry data include the Institute of Nuclear Power Operations (INPO), EPRI, CHUG, FAC NET data sources.

The staff's review of the license renewal basis calculation for the Flow-Accelerated Corrosion Program indicated that it also assesses carbon steel piping locations that the NRC has described in information notices (INs), GLs, or bulletins as susceptible to FAC:

- Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants," November 6, 1987.
- GL 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning," May 2, 1989.
- IN 89-53, "Rupture of Extraction Steam Line on High Pressure Turbine," November 6, 1987.
- IN 91-18, High-Energy Piping Failures Caused by Wall Thinning, March 12, 1991.
- IN 92-35, "Higher Than Predicted Erosion/Corrosion in Unisolable Reactor Coolant Pressure Boundary Piping Inside Containment at a BWR," May 6, 1992.
- IN 93-21, Summary of NRC Staff Observations Compiled During Engineering Audits or Inspections of Licensee Erosion/Corrosion Programs, March 25, 1993.

- IN 95-11, "Failure of Condensate Piping Because of Erosion/Corrosion at a Flow-Straightening Device," February 24, 1995.

- IN 97-84, "Rupture in Extraction Steam Piping as a Result of Flow-Accelerated Corrosion," December 11, 1997.

The staff reviewed the FAC records for UT examinations during the last refueling outage, noted that the carbon steel components selected for examination included locations based on industry operating experience, and concluded that the applicant includes operating experience in selecting carbon steel piping locations for UT examination. The staff also noted that the applicant replaces any carbon steel piping exhibiting an unacceptable amount of FAC-induced wear with stainless steel or chromium-molybdenum alloy steel piping with chromium content of at least 1-1/4 (1.25) percent. The chromium levels in these steels makes them more resistant than carbon steel materials to FAC. The chromium level also permits exclusion of the replaced components from the scope of the program (*i.e.*, the EPRI guidelines permit exclusion of stainless steel piping or alloy steel piping with 1.25 chromium from FAC programs).

Based on this review, the staff concludes that the applicant's Flow-Accelerated Corrosion Program includes programmatic controls to track and incorporate industry and plant-specific operating experience for use in selecting carbon steel piping locations for UT examination and that the "operating experience" program element of the Flow-Accelerated Corrosion Program is acceptable because the applicant uses industry operating experience as a basis for supplementing the scope of the program and for selecting and scheduling the component inspections implemented by this AMP.

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.

FSAR Supplement. In LRA Section A.1.1.7, the applicant provided the FSAR supplement for the Flow-Accelerated Corrosion Program. The staff reviewed this section and determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff determined that the applicant states that the Flow-Accelerated Corrosion Program will be enhanced to ensure consistency with the program elements of GALL AMP XI.M17, "Flow-Accelerated Corrosion," and that this enhancement is Commitment No. 5 in the LRA and a reference in FSAR Supplement Section A.1.1.7.

Based on this review, the staff concludes that FSAR Supplement A.1.1.7 is acceptable because adequately describes the Flow-Accelerated Corrosion Program and incorporates Commitment No. 5.

Conclusion. On the basis of its audit and review of the applicant's Flow-Accelerated Corrosion Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Bolting Integrity Program

Summary of Technical Information in the Application. LRA Section B.2.8 describes the existing Bolting Integrity Program as consistent, with exceptions and enhancement, with GALL AMP XI.M18, "Bolting Integrity."

The applicant stated that the Bolting Integrity Program addresses aging management requirements for bolting on mechanical components within the scope of license renewal. The Bolting Integrity Program utilizes industry recommendations and EPRI guidance that consider material properties, joint/gasket design, chemical control, service requirements, and industry and plant-specific operating experience in specifying torque and closure requirements. The program relies on staff recommendations for a bolting integrity program as in NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," and industry recommendations as in EPRI Reports NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," and TR-104213, "Bolted Joint Maintenance & Applications Guide," for pressure-retaining bolting within the scope of license renewal.

The applicant also noted that safety-related bolting and closure inspections, monitoring/trending, and repair/replacement are under the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. Nonsafety-related pressure-retaining bolting and closure inspection, monitoring, and trending are under the External Surfaces Monitoring Program. Degraded conditions are also subject to the Corrective Action Program.

The Bolting Integrity Program periodically inspects closure bolting for loss of preload, cracking, and loss of material due to corrosion and rust and takes measures to prevent or minimize loss of preload and cracking.

The applicant further stated that other AMPs (*e.g.*, GALL AMP XI.M1, "ASME Section XI Inspection (ISI) Subsections IWB, IWC, and IWD," and GALL AMP XI.S3, "ASME Section XI Subsection IWF") that also manage inspection of safety-related bolting supplement the Bolting Integrity Program.

HNP has included no high-strength structural bolts within the scope of license renewal; therefore, the Bolting Integrity Program includes no activities of the ASME Section XI, Subsection IWF Inservice Inspection 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 exceptions and enhancement to determine whether the AMP, with the exceptions and enhancement, remained adequate to manage the aging effects for which the LRA credits it.

Enhancement. The LRA states the following enhancement to meet the GALL Report program element "preventive actions," specifically:

> The HNP procedures for torquing/bolted connections MMM-010, "Threaded Fastener Tightening Procedure," Reference 5.24, Attachment 5, will be revised to prohibit the use of Molybdenum Disulfide Lubricants (e.g., Molycote).

In a letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 6) to enhance the program implementing procedures by prohibiting the use of molybdenum disulfide lubricants. The staff finds this commitment acceptable because the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the "preventive actions" program element.

Exception. The LRA states the following exception to the GALL Report program elements "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions," specifically:

> GALL AMP XI.M1 describes the ASME Section XI, Subsections IWB, IWC and IWD, Inservice Inspection Program as conforming to the requirements of the ASME Code, Section XI, Subsections IWB, IWC and IWD in the 2001 Edition including the 2002 and 2003 Addenda. However, as noted in the description of GALL AMP XI.M1, 10 CFR 50.55a governs the application of Codes and Standards. In conformance with 10 CFR 50.55a(g)(4)(ii), the ISI Program is updated during each successive 120-month inspection interval to comply with the requirements of the latest edition and addenda of the Code specified 12 months before the start of the inspection interval. The differences between the HNP code of record and the Code edition specified in the GALL Report are considered to be an exception to the GALL Report criteria.

The applicant stated that it had added an exception to the Bolting Integrity Program as to the reference to the ASME Code 1995 Edition with 1996 Addenda in GALL AMP XI.M18. The applicant's edition of record is the 1989 Edition with no addenda, an exception to the GALL Report. The staff compared the examination requirements of Tables IWB-2500-1 and IWC-2500-1 in the 1995 Edition with 1996 Addenda against those of the 1989 Edition, found them consistent, and finds the applicant's Bolting Integrity Program, with the exception, acceptable because the HNP edition of record is consistent with GALL Report requirements.

Operating Experience. LRA Section B.2.8 states that operating experience shows the Bolting Integrity Program as continually upgraded based on industry experience, research, and routine program performance. The applicant stated that the program, through its continual improvement, assures the capability of mechanical bolting to support plant safety throughout the period of extended operation.

During the audit and review, the staff reviewed various action requests on bolting issues and descriptions of their corrective actions addressed in the following paragraphs.

In one action request on a leak on a 12-inch 90-degree elbow due to failed bolting in the fire protection piping discovered after a fire pump start, the ensuing investigation included an engineering review and a metallurgical analysis. Corrective actions replaced the elbow, realigned the piping, and installed a thrust block.

In another action request on three flange bolts missing from a valve to expansion joint bolted connection, the ensuing investigation concluded that the bolts had been missing since the original installation of the joint. Corrective actions installed the proper bolting material.

On the basis of its review of this plant-specific operating experience and discussions with the applicant's technical personnel, the staff finds that the applicant's Bolting Integrity Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.8, the applicant provided the FSAR supplement for the Bolting Integrity Program. Also, in a letter dated August 20, 2007, the applicant stated Commitment No. 6 to enhance the Bolting Integrity Program prior to the period of extended operation. The staff reviewed this section and determines that, with Commitment No. 6, the information in the FSAR 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 Bolting Integrity 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. Also, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. 6 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Steam Generator Tube Integrity Program

Summary of Technical Information in the Application. LRA Section B.2.9 describes the existing Steam Generator Tube Integrity Program as consistent, with exceptions and enhancements, with GALL AMP XI.M19, "Steam Generator Tube Integrity."

The applicant stated that the Steam Generator Tube Integrity Program, part of the overall Steam Generator Integrity Program, is credited for aging management of the tubes, tube plugs, tube supports, and secondary-side components whose failure could prevent the steam generator from fulfilling its intended safety function. The Steam Generator Integrity Program is based on technical specification requirements and meets the intent of NEI 97-06, "Steam Generator Program Guidelines." The Steam Generator Tube Integrity Program manages aging effects by a combination of prevention, inspection, evaluation, repair, and leakage monitoring. Preventive measures are intended to mitigate by primary-side and secondary-side water chemistry monitoring and control degradation from corrosion phenomena. Foreign material exclusion requirements are intended to inhibit wear degradation. The Steam Generator Tube Integrity Program provides the actions to be taken in response to detection of foreign objects.

The applicant also stated that the Steam Generator Tube Integrity Program requires inspection activities to detect flaws in tubing, plugs, tube supports, and secondary-side internal components needed to maintain tube integrity. Degradation assessments identify both potential and existing degradation mechanisms. Inservice inspections (*i.e.*, eddy current testing and visual inspections) detect flaws. Condition monitoring compares the inspection results against performance criteria, and an operational assessment predicts tube conditions so performance criteria will not be exceeded during the next operating cycle. Primary-to-secondary leakage is monitored continually during operation. The steam generators were replaced in 2001. The new steam generators incorporate significant design improvements, including Alloy 690 thermally-treated tubing, stainless steel tube supports and anti-vibration bars, full-depth hydraulically-expanded tubes in the tubesheet, and design features which minimize the deposition of sludge on it.

Staff Evaluation. During its audit and 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, remained adequate to manage the aging effects for which the LRA credits it.

During the review, the staff asked the applicant how many tubes in each steam generator have been plugged or repaired and what steam generator repair methods (plugging, sleeving, kinetic expansion) have been reviewed and approved by the NRC under this program.

In Enclosure 3 of its response dated August 20, 2007, the applicant stated that to date three tubes in Steam Generator A, one in Steam Generator B, and three in Steam Generator C are plugged. The applicant also clarified that, since a steam generator tube surveillance program amendment on March 16, 2007, tubes found by ISI with flaws as deep as 40 percent of nominal tube wall thickness shall be plugged. Because it provided the requested information and stated that plugging is the only repair method for steam generator tubes with flaws exceeding 40 percent of tube wall nominal thickness, the staff finds the applicant's response acceptable.

Exception. The LRA states that the existing Steam Generator Integrity Program, following the enhancement, will be consistent with GALL AMP XI.M19 with exceptions to the "scope of the program," "preventive actions," "detection of aging effects," and "monitoring and trending" program elements:

The Steam Generator Tube Integrity Program has been established to meet the intent of NEI 97-06, "Steam Generator Program Guidelines," Revision 2. The GALL Report refers to Revision 1 of NEI 97-06. This is a difference with the GALL Report. HNP is committed to the implementation of the latest revision of NEI 97-06. The updated NEI 97-06 document incorporates the latest industry operating experience, which strengthens the intent of NEI 97-06 to establish a framework for structuring and strengthening existing steam generator programs. The NRC has not approved NEI 97-06 but recognizes its usefulness as a framework for structuring an effective steam generator program. The NRC stated in GALL AMP XI.M19, that a licensee's plant Technical Specifications, response to GL 97-06, and commitment to implement the steam generator degradation management program described in NEI 97-06 are adequate to manage the effects of aging on the steam generator tubes, plugs, sleeves, and tube supports. Therefore, use of the latest revision of NEI 97-06 is justified.

During the review and audit, the staff asked the applicant to explain the major differences between NEI 97-06, Revision 1 and Revision 2 and to clarify how they affect the "scope of the program," "preventive actions," "detection of aging effects," and "monitoring and trending" program elements. The applicant's response in Enclosure 3 of its letter dated August 20, 2007, stated that HNP's commitment to NEI 97-06, Revision 2, consistent with NRC and industry adoption of improved steam generator technical specifications, is a CLB change. The NRC in its letter to the applicant dated March 16, 2007, approved adoption of the improved steam generator technical specifications. The applicant also explained that NEI 97-06, Revision 2, summarizes its changes from NEI 97-06, Revision 1. On the basis that the NRC has reviewed and approved the applicant's commitment to NEI 97-06, Revision 2, the staff finds the applicant's response and exception to the GALL AMP XI.M19 acceptable.

Enhancement. The LRA states that, prior to the period of extended operation, an enhancement to the existing program will affect the "scope of the program," "parameters monitored or inspected," and "corrective actions" program elements, specifically:

Enhance the program implementing procedure to require that degraded tube plugs and secondary side components (e.g., tube supports) are evaluated for corrective actions.

The applicant in Enclosure 1 to its letter dated November 14, 2006, committed (Commitment No. 7) to implement the enhancement prior to the period of the extended operation. During the audit, the staff reviewed the applicant's supporting documents, including the license renewal program evaluation report and the Steam Generator Integrity Program (EGR-NGGC-0208), Revision 1, and noted that this existing program will be consistent with the GALL AMP with this enhancement describing instructions for corrective action evaluations for degraded tube plug or secondary-side components. On the basis of this review, the staff finds the applicant's proposed enhancement acceptable.

Operating Experience. LRA Section B.2.9 states that the Steam Generator Tube Integrity Program is implemented and maintained in accordance with the general requirements for engineering programs for assurance that the program meets regulatory and procedural requirements and that qualified personnel assigned as program managers have authority and responsibility to implement the program and to commit adequate resources to program activities.

The applicant stated that the Steam Generator Integrity Program utilizes operating experience to promote the transfer of lessons learned from both internal and industry events so the knowledge gained can be used to improve nuclear plant safety and operations. Operating experience provides the methodology for receiving, processing, screening, reviewing, and evaluating information, status reporting, and taking preventive and corrective actions.

The applicant also noted that industry operating history shows that plant-specific operating experience of the HNP replacement steam generators is similar to that of other replacement steam generators with thermally-treated Alloy 690 tubes and design enhancements which minimize the likelihood of degradation. There have been no reported instances of cracking in thermally-treated Alloy 690 tubes at any US plants; the only indications to date are from wear (fretting) due to loose parts, tube supports, anti-vibration bars, and from manufacturing or handling anomalies.

The applicant further stated that plant-specific condition reports, internal and external assessments, and operating history show the Steam Generator Integrity Program to be critically monitored, effectively maintaining tube integrity, and continually improving. The overall effectiveness of the Steam Generator Integrity Program is proven by SSC operating experience; no tube integrity-related degradation has led to loss of component intended function.

During the audit, the staff interviewed the applicant's technical personnel and reviewed the operating experience described in the Steam Generator Tube Integrity Program supporting documents, including the license renewal program evaluation report. During the review, the staff noted that, although the applicant had described industry and plant-specific steam generator integrity program operating experience in its supporting documents, the LRA Section B.2.9 "operating experience" program element does not state specific operating experience details. The staff requested from the applicant additional information about Steam Generator Tube Integrity Program operating experience, specifically (1) a listing and a brief summary of the industry operating experience addressing whether it is relevant to the program and, if so, whether it introduced any new requirements and (2) a listing and a brief summary of plant-specific operating experience history addressing condition reports, corrective actions, and how the corrective actions were resolved, specifically whether these conditions introduced any new requirements to the program.

The applicant's response in Enclosure 3 of its letter dated August 20, 2007, listed industry operating experience for the Steam Generator Tube Integrity Program and stated that:

> The above [listed in the August 20, 2007, letter] industry operating experience items were reviewed for applicability to the HNP steam generator tube integrity program, as follows:

With respect to the NRC Generic Letters, HNP found that steam generator tube inspections are consistent with the NRC's position regarding tube inspections. Additionally, HNP has submitted an application for Technical Specification improvement regarding steam generator tube integrity consistent with NRC and industry adoption of improved steam generator Technical Specifications. The adoption of the improved steam generator Technical Specifications has been approved by the NRC. The subject NRC Information Notices and Licensee Event Reports were reviewed and found not to be directly applicable to the present-day HNP Model Delta 75 steam generators. Although the operating experience was not directly applicable to the HNP steam generators, the underlying aging mechanisms were also reviewed. The aging mechanisms associated with the NRC Information Notices and Licensee Event Reports were found to be addressed by the HNP steam generator tube integrity program. INPO Operating Experience was reviewed for applicability to the HNP steam generator tube integrity program. For those events that were directly related to the present-day HNP Model Delta 75 steam generators, it was found that the HNP steam generator tube integrity program addressed the concerns identified. For those events that were not directly related to the present-day HNP Model Delta 75 steam generators, the underlying aging mechanisms were also reviewed. The aging mechanisms associated with the INPO Operating Experience were found to be addressed by the HNP steam generator tube integrity program.

Further, the applicant's response in Enclosure 3 of the letter dated August 20, 2007, summarized plant-specific operating experience:

A review of plant-specific condition reports, internal and external assessments was conducted and showed the Steam Generator Integrity Program to be critically monitored, effective in maintaining tube integrity, and continually improving.

Corrective actions introducing new requirements to the Steam Generator Integrity Program associated with Nuclear Condition Reports (NCRs) consisted of the following:

Revision to the Steam Generator Tube Integrity Surveillance Test Procedure to improve identification/storage of various eddy current probes brought on site.

Revision to the HNP Steam Generator Program Procedure to incorporate an independent review of the foreign object search and retrieval data.

Revision to the HNP procedures to require verification of the automated analysis parameters during the Site-Specific Performance Demonstration

Corrective actions introducing new requirements to the Steam Generator Integrity Program associated with external and internal assessments consisted of the following:

Action items to improve the documentation for eddy current techniques, tube plug inspection acceptance criteria, documentation of deviations to EPRI documents used in the Steam Generator Integrity Program guidelines, long-range planning of inspection activities for the replacement steam generators, and improvements in implementation of chemistry and primary-to-secondary leakage procedures.

Additional actions taken included: (1) improvements in the documentation of actions from tube leak events, (2) improvements in degradation assessment, condition monitoring, and operational assessment procedures, (3) improvements in Steam Generator in-service inspection procedures, (4) improvements in primary-to-secondary leak detection procedures, and (5) review of the In-Service Inspection vendor root cause analyses.

The NRC audit team reviewed operating experience details during the AMR audit and determined that the applicant adequately incorporated industry and plant-specific operating experience into the Steam Generator Integrity Program. On the basis of this determination, the staff found the applicant's response acceptable.

The staff noted that IN 97-88, "Experiences During Recent Steam Generator Inspections," dated December 16, 1997, states that in May 1997 the Shearon Harris Nuclear Power Plant licensee found extensive damage to four perforated carbon steel ribs in a steam generator. The ribs are welded to the feedwater impingement plate which shields the steam generator tubes from direct impact of the feedwater flow. The licensee concluded that the high-flow velocities of the feedwater had eroded the ligaments between the perforation on the ribs.

The staff asked the applicant to explain whether loss of material due to erosion is present at the secondary side components of the replaced steam generators and how the Steam Generator Tube Integrity Program will prevent, inspect, detect, or monitor for this aging effect.

The applicant's response in Enclosure 3 of the letter dated August 20, 2007, provided a table showing the steam generator feedwater impingement plate and support and the steam generator tube bundle wrapper as steam generator secondary side components susceptible to loss of material due to erosion. The applicant added that the One-Time Inspection Program by visual or volumetric inspection or both will verify for the feedwater impingement plate and support whether degradation has occurred or will trigger additional actions to maintain intended functions of the affected components during the period of extended operation. The staff finds the applicant's response acceptable, on the basis of no operating experience with erosion of impingement plates and supports in the replaced steam generators. In addition, the One-Time Inspection Program inspections will be adequate to verify whether any loss of material due erosion occurs.

The applicant stated that, consistent with the GALL Report, the Steam Generator and Water Chemistry Programs manage aging effects due to erosion for the steam generator tube bundle wrapper. SER Sections 3.0.3.1.1 and 3.0.3.2.6 document the staff's evaluation of the applicant's Water Chemistry Program and of its Steam Generator Tube Integrity Program. On this basis, the staff agrees with the applicant that loss of steam generator tub bundle wrapper material due to erosion will be adequately managed during the period of extended operation. On the basis of its reviews, the staff found the applicant's response on aging effects due to erosion 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.

FSAR Supplement. In LRA Section A.1.1.9, the applicant provided the FSAR supplement for the Steam Generator Tube Integrity Program. This section of the LRA states:

> The Steam Generator Tube Integrity Program is credited for aging management of the tubes, tube plugs, tube supports, and the secondary-side components in which failure could prevent the steam generator from fulfilling its intended safety function, for the period of extended operation. The Steam Generator Tube Integrity Program is based on an existing program, the Steam Generator Integrity Program. The Steam Generator Integrity Program is based on Technical Specification requirements, and meets the intent of NEI 97-06, "Steam Generator Program Guidelines."
>
> Prior to the period of extended operation, the program implementing procedure will be enhanced to include a description of the instructions for implementing corrective actions if tube plugs or secondary-side components (e.g., tube supports) are found to be degraded.

In Enclosure 1 of its letter dated November 14, 2006, the applicant committed (Commitment No. 7) to enhance the program implementing procedure to include instructions for corrective actions for degraded tube plugs or secondary-side components (*e.g.*, tube supports) prior to the period of extended operation. The staff evaluation of this enhancement is under "Enhancement" of this program. The staff reviewed this commitment and LRA Section A.1.1.9 and determines that the information in the FSAR 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 Steam Generator Tube Integrity 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. Also, the staff reviewed the enhancements and confirmed that their implementation 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Closed-Cycle Cooling Water System Program

Summary of Technical Information in the Application. LRA Section B.2.11 describes the Closed-Cycle Cooling Water System Program as consistent, with exceptions, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System."

The applicant stated that the Closed-Cycle Cooling Water System Program addresses aging management of components in the component cooling water and essential services chilled water systems and components in other systems cooled by these systems. This program also manages the jacket water components of the emergency diesel generators, diesel-driven fire pump, and security diesel. These systems are closed cooling loops with controlled chemistry consistent with the GALL Report description of a closed cycle cooling water system. In order to minimize corrosion, this program maintains system corrosion inhibitor concentrations within specified limits of "Closed Cooling Water Chemistry Guideline: Revision 1 to TR-107396, Closed Cooling Water Chemistry Guideline," EPRI, Palo Alto, CA: 2004. Surveillance testing and inspection in accordance with standards in the above EPRI report evaluates system and component performance. These measures ensure that the closed-cycle cooling water system and components serviced by that system perform their functions acceptably.

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

Exception 1. The LRA states the following exception to the GALL Report program element "preventive action," specifically:

> The Closed-Cycle Cooling Water System Program currently uses the 2004 version of the EPRI Closed Cooling Water Chemistry Guideline. However, the GALL Report references the 1997 version.

During the audit and review, the staff reviewed the Closed-Cycle Cooling Water System Program procedure for establishing water chemistry parameters. Based on this review, the staff confirmed that wherever Revision 1 of the EPRI guideline relaxed the criteria the implementing procedure reverted to the Revision 0 version of the guideline. Where acceptable parameter values were tightened, the implementing procedure used the tighter values. Based on the review of the implementing procedure, the staff finds the applicant's implementation of the guidance at least conservative as the GALL Report recommendations and therefore acceptable.

Exception 2. The LRA states the following exception to the GALL Report program element "parameters monitored or inspected," specifically:

> Some heat exchangers are not monitored for flow, inlet and outlet temperatures, and differential pressure. In these cases, either the functionality of these heat exchangers is verified by activities outside the Closed-Cycle Cooling Water System Program or the specific operating conditions of the heat exchanger render performance testing unreliable.

During the audit and review, the staff asked the applicant which specific heat exchangers are not monitored for flow, inlet and outlet temperatures, and differential pressure and to describe how activities outside the Closed-Cycle Cooling Water System Program verify the performance of these heat exchangers.

In its response dated August 20, 2007, the applicant stated:

> Flow, temperature and pressure are not specifically monitored in the following heat exchangers. As noted in LRA Section B.2.11, in these cases, either the functionality of these heat exchangers is verified by activities outside the Closed-Cycle Cooling Water System Program or the specific operating conditions of the heat exchanger render performance testing unreliable.
>
> Primary Sample Condenser and Cooler - The performance of the sample coolers and condensers is validated as the system is used by chemistry personnel. These components are not needed for safe shutdown and not required to mitigate the consequences of an accident.
>
> Component Cooling Water Heat Exchangers - The component cooling water heat exchangers are tested or inspected as part of HNP's commitments to Generic Letter 89-13 as described in the Open-Cycle-Cooling Water System Program in LRA Section B.2.10. An engineering evaluation concluded that factors inherent in the testing process make the test results too unreliable to be used for operability determinations or as a basis for an inspection program. In addition, temperature and pressures are indicated on the main control board and operations monitors them to ensure they are performing as expected for the plant conditions.
>
> Emergency Diesel Generator Oil and Jacket Water Coolers - The emergency diesel generator jacket water coolers are tested or inspected as part of HNP's commitments to Generic Letter 89-13 as described in the Open-Cycle Cooling Water System Program in LRA Section B.2.10. Inspection and cleaning of the emergency diesel generator lube oil cooler is included as part of a maintenance periodic test. The degradation of heat exchanger performance can be identified through these inspections.
>
> EDG Turbocharger Intercoolers - The combustion air intercoolers are inspected or cleaned as part of the periodic diesel generator maintenance. The degradation of heat exchanger performance can be identified through this inspection.
>
> Reactor Coolant Drain Tank (RCDT) Heat Exchanger - The RCDT heat exchanger performs no safety-related heat transfer function. The heat exchanger tubes provide a pressure boundary function. Nevertheless, reactor coolant drain tank heat exchanger high temperature is annunciated and the procedural response is to investigate temperature increases that would indicate heat exchanger fouling.
>
> Fuel Pool Heat Exchangers - Testing is not performed for the same reasons associated with the component cooling water heat exchangers above. Degradation of heat exchanger performance can be identified through control room and local alarms. This is considered an exception because specific performance testing is not performed. Per

FSAR Section 9.1.3: 'Control Room and local alarms are provided to alert the operator of high and low pool water level, and high temperature in the fuel pool. A low flow alarm, based on measured flow to the fuel pool, is provided to warn of interruption of cooling flow.'

Air Handling Unit Cooling Coils - The safety-related air handling units are periodically inspected and differential pressures recorded. The condition of heat exchanger performance can be identified through this inspection. This is considered an exception because specific performance testing is not performed. Per procedures, operations performs periodic monitoring of the rooms cooled by these safety-related units.

The licensing renewal activities described above along with the activities described in the Closed-Cycle Cooling Water System Program ensure the performance and structural integrity of these heat exchangers will be maintained during the period of extended of operation.

For such heat exchangers there is no specific performance testing so the applicant has listed them as exceptions; however, in each case, as described, there is adequate indication, through visual inspections, operating performance, and through flow, pressure, or temperature indications in the control room, that the heat exchangers perform their intended function. Some of these indications have alarms. The staff finds this exception acceptable because there is sufficient indication that the heat exchangers perform their intended function.

Exception 3. The LRA states the following exception to the GALL Report program element "detection of aging effects, specifically:

Some heat exchangers that are not normally in operation are not periodically tested to ensure operability. However, the functionality of these heat exchangers is verified by activities outside the Closed-Cycle Cooling Water System Program.

During the audit and review, the staff confirmed that there are two heat exchanger component types not normally in service and not periodically tested for operability, the spent fuel pool heat exchangers and the air-handling units cooled by the component cooling water. The spent fuel pool heat exchangers operate not continuously but when pool temperature exceeds 105 °F. When the spent fuel pool heat exchangers operate in modes 1-3, pool temperature monitoring ensures that it does not exceed 127.5 °F. Because of the importance assigned to the spent fuel pool temperature, the plant's operation staff would detect any significant degradation in heat exchanger performance and take appropriate corrective action. Monitoring of the spent fuel pool temperature readily indicates operability of the spent fuel pool heat exchangers. Inspection verifies the condition of the air-handling units cooled by component cooling water. During the audit and review, the staff also confirmed that temperature monitoring in rooms cooled by the air-handling units indicates by elevated area temperature air-handling units not operable. On the basis that there is sufficient indication through temperature monitoring and inspections of operability of these components not normally in service, the staff finds this exception acceptable.

During the audit and review, the staff reviewed a number of procedures for the performance testing of pumps in the Closed-Cycle Cooling Water System Program. The staff found the pumps tested quarterly in accordance with acceptance criteria for flow and inlet and outlet pressures consistent with GALL Report recommendations. In addition, the staff reviewed the plant procedure implementing water chemistry control processes and confirmed that the chemistry sampling frequencies are in accordance with EPRI water chemistry guidelines. The staff also confirmed by review of procedures that the Environmental and Chemistry Unit reviews, trends, and assesses plant chemistry data.

Operating Experience. LRA Section B.2.11 states that operating experience shows no evidence of age-related degradation for components wetted by the HNP closed-cycle cooling water systems. Components that interact with the service water system (*e.g.*, heat exchanger tubes) have experienced degradation.

The applicant stated that operating experience shows that the Closed-Cycle Cooling Water Program is upgraded continually based on industry experience, external and internal assessments, and routine program performance and has mitigated loss of material, cracking, and reduction of heat transfer effectiveness effectively.

During the audit and review, the staff reviewed plots of plant chemistry data back to 1997 for various components within the Closed-Cycle Cooling Water System Program indicating that plant personnel maintain chemistry parameters within established limits. The staff also reviewed recent NRC integrated inspection reports and noted no adverse trends or violations in the chemistry program from 1999 through 2006.

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.

FSAR Supplement. In LRA Section A.1.1.11, the applicant provided the FSAR supplement for the Closed-Cycle Cooling Water System Program. The staff reviewed this section and determines that the information in the FSAR 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 Closed-Cycle Cooling Water System 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 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 FSAR 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 Boraflex Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.12 describes the existing Boraflex Monitoring Program as consistent, with enhancements, with GALL AMP XI.M22, "Boraflex Monitoring."

The applicant stated that the Boraflex Monitoring Program assures that no unexpected degradation of the Boraflex neutron-absorbing material compromises the criticality analysis for spent fuel storage racks. The program periodically inspects test coupons, correlates measured levels of silica in the spent fuel pool with analysis using a predictive code (e.g., RACKLIFE) to estimate boron loss from Boraflex panels, and tests neutron attenuation to measure the boron areal density of the test coupons. The Boraflex Monitoring Program will be enhanced to require periodic *in-situ* neutron attenuation testing (blackness testing) of boron areal density and the use of EPRI RACKLIFE predictive code or its equivalent to correlate the measured levels of silica in the spent fuel pool to estimate boron loss from Boraflex panels. The Boraflex Monitoring Program will be in use until a new criticality analysis eliminates credit for Boraflex in the spent fuel pools still reliant on the neutron-absorbing material to maintain sub-criticality.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it.

Enhancement 1. The LRA states the following enhancement to the GALL Report program elements "preventive actions," "parameters monitored or inspected," and "detection of aging effects," specifically:

> The Boraflex Monitoring Program will be enhanced to include measurements of actual boron areal density using in-situ techniques.

During the audit and review, the staff noted that a plant-specific procedure monitors the integrity of the Boraflex neutron-absorbing material in the spent fuel racks through an engineering test. The applicant will revise the procedure to measure actual boron areal density using *in-situ* techniques and to announce that this procedure involves license renewal commitments. The revised procedure will measure the boron areal density of the Boraflex material for degradation due to exposure to gamma radiation. This commitment will address the gradual thinning of the Boraflex material due to the dissolution of silica and consequent loss of neutron-absorbing capability.

The applicant proposed a commitment (Commitment No. 8) to enhance the program implementing procedure to measure actual boron areal density of the boraflex within the scope of license renewal. The staff finds this enhancement acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements.

Enhancement 2. The LRA states the following enhancement to the GALL Report program elements "preventive actions" and "detection of aging effects,"specifically:

> Administrative controls that implement the program will be enhanced to include neutron attenuation testing (blackness testing), to determine gap formation in Boraflex panels.

During the audit and review, the staff noted that a plant-specific procedure monitors the integrity of the Boraflex neutron-absorbing material in the spent fuel racks and will test neutron attenuation to determine gap formation. The applicant will revise the procedure to announce that it involves license renewal commitments. The revised procedure will detect gaps in the Boraflex material occurring during long-term exposure to gamma radiation in a wet pool environment. This commitment will address monitoring for gap formation in the Boraflex material and consequent loss in local areas of neutron-absorbing capability.

The applicant proposed a commitment (Commitment No. 8) to enhance the program implementing procedure to test neutron attenuation in boraflex panels within the scope of license renewal. The staff finds this enhancement acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "preventive actions" and "detection of aging effects" program elements.

Enhancement 3. The LRA states the following enhancement to the GALL Report program elements "preventive actions" and "detection of aging effects," specifically:

> The HNP Boraflex Monitoring Program will be enhanced to include the use of EPRI RACKLIFE predictive code or its equivalent.

During the audit and review, the staff noted that HNP already uses the EPRI RACKLIFE predictive code. The code uses data from the spent fuel pool chemistry sampling results controlled by a plant-specific procedure. The Boraflex Monitoring Program uses the EPRI RACKLIFE predictive code. The applicant has made license renewal commitments for the Boraflex Monitoring Program. The EPRI RACKLIFE code will be a tool for predicting and trending Boraflex degradation from silica levels in the spent fuel pool.

The applicant proposed a commitment (Commitment No. 8) to enhance the program implementing procedure to include a code to predict and trend degradation of Boraflex within the scope of license renewal. The staff finds this enhancement acceptable because the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements.

Operating Experience. LRA Section B.2.12 states that HNP has used predictive codes (*e.g.*, RACKLIFE) to confirm data determined from surveillance coupon testing and silica trend data. In addition, the normal operating review process records operating experience regularly. The applicant stated that it has implemented corrective actions as results of Boraflex Monitoring Program inspections, tests, and analyses and review of recent industry operating experience (*i.e.*, NRC Generic Letter 96-04) recorded in corrective action documents. The staff cited two items of most importance reported in action requests described as "Boraflex Degradation of BWR Fuel Storage Racks at HNP" and "RACKLIFE Model of PWR Fuel." Both conditions addressed Boraflex degradation in the PWR racks. The applicant further stated that its corrective actions resolved these items and formalized the process of initiating preventive maintenance inspections at prescribed frequencies.

The applicant also stated that these operating experience results prove that the Boraflex Monitoring Program ensures the continuing integrity of Boraflex neutron-absorbing material where required to meet criticality analyses for the spent fuel storage racks.

During the audit and review, the staff reviewed the operating experience described in the LRA and the 2003 inspection results, finding them very comprehensive and detailed. The staff's review focused primarily on the most recent results. The applicant had not initiated any new action requests in response to these.

During the audit and review, the staff reviewed the two action requests on Boraflex degradation of boiling-water reactor (BWR) fuel storage racks and the use of the RACKLIFE Model. These action requests followed detection by the Boraflex Monitoring Program of degradation of the neutron absorber sheets credited in criticality analyses for the spent fuel racks. Conditions documented included loss of boron from the Boraflex material. Resolution of the condition requires continued monitoring of the Boraflex degradation until approval of a new criticality analysis for the affected spent fuel racks.

On the basis of its review of plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Boraflex Monitoring Program will adequately manage the aging effects for which the LRA credits it.

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.

<u>FSAR Supplement</u>. In LRA Section A.1.1.12, the applicant provided the FSAR supplement for the Boraflex Monitoring Program. The staff reviewed this section and determines that the information in the FSAR supplement, with Commitment No. 8, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its audit and review of the applicant's Boraflex Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation (Commitment No. 8) 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 FSAR 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 Inspection of Overhead Heavy Load and Light Load Handling Systems Program

Summary of Technical Information in the Application. LRA Section B.2.13 describes the existing Inspection of Overhead Heavy Load and Light Load Handling Systems Program as consistent, with enhancements, with GALL AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

The applicant stated that the inspections monitor structural members for the absence of signs of corrosion other than minor surface corrosion and crane rails for abnormal wear. The inspections are annual for the fuel handling building cranes and every fuel cycle for the containment building cranes. Other monorail structures located in in-scope structures do not credit this program for aging management because they are addressed and managed as structural steel under the Structures Monitoring 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 enhancements to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it.

During the audit and review, the staff noted that in Commitment Letter HNP 06-0136, dated November 14, 2006, Enclosure 1, the Commitment No. 9 enhancements for the Inspection of Overhead Heavy Load and Light Load Handling Systems Program are not consistent with LRA Sections A.1.1.13 and B.2.13. The staff asked the applicant to explain these discrepancies.

In its response dated August 20, 2007, the applicant stated that LRA Commitment No. 9 and Section B.2.13 were not and should be consistent with LRA Section A.1.1.13 and the license renewal basis calculation.

The applicant further stated that this response, HNP-06-0136, Enclosure 1, "Harris Nuclear Plant License Renewal Commitments," amended Commitment No. 9 for consistency agree with LRA Section A.1.1.13 and the license renewal basis calculation as follows:

> Commitment No. 9, item (7) will be deleted.

LRA Section B.2.13, "Detection of Aging Effects," Item (1) was changed to state:

> "to include all cranes that are within the scope of license renewal."

After these changes, there were only four (4) enhancement items in Harris Commitment Letter HNP-06-0136, Enclosure 1. (Commitment No. 9)

In the same August 20, 2007 letter, the applicant amended Commitment No. 9, as follows:

> The program will be enhanced to: (1) include in the program all cranes within the scope of license renewal; (2) require the responsible engineer to be notified of unsatisfactory

crane inspection results; (3) specify an annual inspection frequency for the fuel cask handling crane, fuel handling bridge crane, and fuel handling building auxiliary crane, and every refuel cycle for the polar crane, jib cranes, and reactor cavity manipulator crane, and (4) include a requirement to inspect for bent or damaged members, loose bolts/components, broken welds, abnormal wear of rails, and corrosion (other than minor surface corrosion) of steel members and connections.

The staff finds the applicant's response acceptable. The number of program enhancements listed in Commitment No. 9 of the License Renewal Commitments, Revision 1, LRA Section B.2.13, and LRA Section A.1.1.13 now agree. The correct number of unique enhancements to the Inspection of Overhead Heavy Load and Light Load Handling Systems Program after the LRA amendment (which revised the license renewal commitments) is four. The following enhancement evaluations are based on the amendment to reduce the number of enhancements from five to four in LRA Section B.2.13. Only these four enhancements are require evaluation after the amendment.

Enhancement 1. The LRA states the following enhancement to meet the GALL Report program element "scope of the program," specifically:

> Revise administrative controls to include all cranes that are within the scope of license renewal.

During the audit and review, the staff noted that implementation of the Inspection of Overhead Heavy Load and Light Load Handling Systems Program is through corporate and plant-specific procedures. Inspection of overhead heavy load and light load handling systems is through the corporate maintenance rule structures monitoring procedure. The applicant will revise this procedure to include all cranes within the scope of license renewal, not just maintenance rule cranes.

The applicant proposed a commitment (Commitment No. 9, item No. 1) to enhance the program implementing procedure to include all cranes within the scope of license renewal. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "scope of the program" program element.

Enhancement 2. The LRA states the following enhancement to the GALL Report program element "parameters monitored or inspected," specifically:

> Revise administrative controls to require notification of the responsible engineer of unsatisfactory inspection results.

During the audit and review, the staff noted that implementation of the Inspection of Overhead Heavy Load and Light Load Handling Systems Program is through corporate and plant-specific procedures. Inspection of overhead heavy load and light load handling systems is through plant-specific procedures which document inspections for the reactor cavity manipulator crane (Enhancement 3), fuel-handling bridge crane, fuel-handling building auxiliary crane, jib cranes, polar crane, and the fuel cask-handling crane. The applicant will revise these procedures to require maintenance to notify responsible engineers of any crane inspection results unsatisfactory for license renewal

The applicant proposed a commitment (Commitment No. 9, item No. 2) to enhance program implementing procedures to require notification to responsible engineers of unsatisfactory crane inspection results. The staff finds this commitment acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the "parameters monitored or inspected" program element.

Enhancements 3 and 4. The LRA states the following unique enhancements to the GALL Report program element "detection of aging effects," specifically:

> Revise administrative controls to specify an annual inspection frequency for the fuel cask handling crane, fuel handling bridge crane, and fuel handling building auxiliary crane, and every refuel cycle for the polar crane, jib cranes, and reactor cavity manipulator crane.
>
> Revise administrative controls to include requirements to inspect for bent or damaged members, loose bolts or components, broken welds, abnormal wear of rails, and corrosion (other than minor surface corrosion) of steel members and connections.

During the audit and review, the staff noted that the applicant will revise a corporate procedure to specify an annual inspection frequency for the fuel-handling building cranes and an inspection frequency of every fuel cycle for the containment cranes.

During the audit and review, the staff noted that the applicant will revise plant-specific procedures for the reactor cavity manipulator crane, fuel-handling bridge crane, fuel-handling building auxiliary crane, jib cranes, polar crane, and the fuel cask handling crane to inspect for bent or damaged members, require inspection for loose bolts or components and broken welds, clarify rails to be inspected for abnormal wear, and specify an inspection for corrosion (other than minor surface corrosion) of steel members and connections.

The applicant proposed a commitment (Commitment No. 9, item Nos. 3 and 4 after amendment) to enhance program implementing procedures: (1) to specify an annual inspection frequency for the fuel cask-handling crane, fuel-handling bridge crane, and fuel-handling building auxiliary crane and every refuel cycle for the polar crane, jib cranes, and reactor cavity manipulator crane and (2) to include a requirement to inspect for bent or damaged members, loose bolts or components, broken welds, abnormal wear of rails, and corrosion (other than minor surface corrosion) of steel members and connections. The staff finds these commitments acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the "detection of aging effects" program element.

On this basis, the staff finds all four enhancements acceptable because when they are implemented the Inspection of Overhead Heavy Load and Light Load Handling Systems

Program will be consistent with GALL AMP XI.M23 and will assure adequate management of the effects of aging.

Operating Experience. LRA Section B.2.13 states that plant-specific operating experience shows issues with missing and loose crane components, crane operation anomalies, industry issues, crane manufacturer recommendations, periodic inspections, and regulatory compliance through the corrective action process. The applicant noted that even though there has been no evidence of corrosion or wear reported for the cranes, these aging effects found for other carbon steel components for similar environments still require aging management. The applicant also stated that crane monitoring programs are upgraded continually based upon industry and plant-specific operating experience. The results of this intrusive and proactive approach to the operation and management of cranes validate the effectiveness of procedures implementing the Inspection of Overhead Heavy Load and Light Load Handling Systems Program. The applicant further stated that these results of operating experience prove that the Inspection of Overhead Heavy Load and Light Load Handling Systems Program ensures the continuing integrity of the subject license renewal cranes.

During the audit and review, the staff reviewed the operating experience described in the LRA and an HNP maintenance rule self-assessment for the period from June 30, 2003, to November 17, 2004, and found the program effective in meeting 10 CFR 50.65 requirements. The self-assessment reported two weaknesses and five items for management consideration. One weakness in structural items indicated a need to update the maintenance rule database with current performance criteria. Corrective action resolved the weakness.

During the audit and review, the staff reviewed 1999, 2001, and 2005 HNP corporate Nuclear Assessment Section assessments of the Maintenance Rule Program. The assessments did not include the Inspection of Overhead Heavy Load and Light Load Handling Systems Program specifically but did include the Maintenance Rule Program, which inspects overhead heavy load and light load handling systems. The 1999 assessment found an issue and a weakness in the Maintenance Rule Program. These deficiency findings resulted in corrective actions which improved the overall Maintenance Rule Program. The 2001 and 2005 assessments found no issues or weaknesses in the Maintenance Rule Program.

During the audit and review, the staff reviewed:

- a summary of system walkdowns, periodic system reviews and vendor inspection reviews documented by the system engineer responsible for the cranes within the scope of license renewal. The staff determined that no entries addressed corrosion of steel or crane wear in the summaries of the system walkdowns and that walkdown conclusions were that the cranes inspected appeared to be in good structural condition. The staff also determined that the periodic system review summary indicated that the reviews are indeed periodic and document a particular crane's history. The summaries indicated no adverse conditions due to corrosion or crane rail wear. In addition, the staff determined from the summary of crane vendor inspection reviews of findings of clearance, brake adjustment, lubrication, broken resistor, missing splice plates, and housekeeping issues that they provide a valuable independent review; however, the summary reviewed indicated no adverse conditions due to corrosion or crane rail wear.

- NRC Inspection Report 50-400/97-07 (1997) which evaluated the effectiveness of HNP implementation of maintenance rule requirements. The inspection concluded that the program was comprehensive and effective. There was no specific mention of the inspection of overhead heavy load and light load handling systems or of system violations or deficiencies.

- various action requests and condition reports written against the cranes within the scope of license renewal. Missing handrails on polar crane access platforms and set screws for the reactor cavity manipulator crane shaft couplings needing replacement were some of the documented conditions of the cranes. The conditions were corrected.

The staff reviewed system engineer notes, the NRC inspection report, and action request and condition report subject matter and found no operating history issues of corrosion of crane structural members or crane rail wear.

On the basis of its review of plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Inspection of Overhead Heavy Load and Light Load Handling Systems Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.13, the applicant provided the FSAR supplement for the Inspection of Overhead Heavy Load and Light Load Handling Systems Program. In a letter dated August 20, 2007, the applicant amended Commitment No. 9 to enhance the Inspection of Overhead Heavy Load and Light Load Handling Systems Program prior to the period of extended operation. The staff reviewed this section and determines that, with the LRA amendment to Commitment No. 9, the information in the FSAR 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 Inspection of Overhead Heavy Load and Light Load Handling Systems Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 9 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Fire Protection Program

Summary of Technical Information in the Application. LRA Section B.2.14 describes the existing Fire Protection Program as consistent, with enhancements, with GALL AMP XI.M26, "Fire Protection."

The Fire Protection Program manages aging of the diesel-driven fire pump fuel oil supply line and credited fire barrier assemblies including fire doors, penetration seals, fire wrap, barrier walls, barrier ceilings and floors, and seismic joint filler. The program is implemented through various plant procedures and will manage the aging effects of the subject components effectively to maintain component intended functions through the period of extended operation.

The applicant stated that it relies on water-based fixed fire suppression systems to meet 10 CFR 50.48 fire protection requirements. The GALL Report refers to fixed suppression systems that use carbon dioxide and Halon. Carbon dioxide systems are not in use at HNP for fire protection. The Halon 1301 extinguishing system for the record storage facility located in the administration building outside the protected area is not needed for compliance with 10 CFR 50.48. In addition, a foam suppression system protects the auxiliary boiler fuel oil tanks, which are at least 500 feet and isolated from any Class 1 structure and structures directly related to power production. The foam suppression system is not needed for compliance with 10 CFR 50.48. The applicant also stated that it uses distributed portable fire extinguishing equipment containing Halon and carbon dioxide in various areas to protect safety-related equipment. These portable extinguishers require no AMP because they are treated as short-lived equipment periodically inspected and replaced as required.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it.

The staff also noted no exceptions to GALL AMP XI.M26, "Fire Protection." The staff reviewed the Fire Protection Program for which the applicant claims consistency with GALL AMP XI.M26 and found it consistent. Furthermore, the staff concludes that the applicant's Fire Protection Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Fire Protection Program consistent with recommended GALL AMP XI.M26, "Fire Protection," and acceptable with enhancements as described:

Enhancement 1. The LRA states an enhancement to the GALL Report program element "parameters monitored/inspected," specifically:

> The HNP Fire Protection Program procedure for periodic inspections of penetration seals will be enhanced to include inspections for signs of degradation as described in NUREG-1801, Section XI.M26, for this program element. This will include requirements to inspect for cracking, seal separation from walls and components, separation of layers

of material, rupture and puncture of seals, which are directly caused by increased hardness, and shrinkage of seal material due to weathering.

This enhancement is acceptable because it will make the program consistent with GALL AMP XI.M26, Element 3, which states that visual inspection of approximately 10 percent of each type of penetration seal proceed during walkdowns at least once every refueling outage. This enhancement is also acceptable for making the program consistent with GALL AMP XI.M26, Element 6, which states that inspection results are acceptable if there are no visual indications (outside those allowed by approved penetration seal configuration) of cracking, separation of seals from wall and components, separation of layers of material, or seal ruptures or punctures. The staff reviewed the applicant's program procedures for whether these elements are consistent with the GALL Report.

On this basis, the staff finds the enhancement acceptable because the enhanced Fire Protection Program will be consistent with GALL AMP XI.M26 and will add assurance of adequate management of aging effects.

Enhancement 2. The LRA states an enhancement to the GALL Report program elements "parameters monitored/inspected," specifically:

> The HNP Fire Protection Program will be enhanced to include a periodic test procedure for inspections of barrier walls, ceilings, and floors on at least an 18-month interval. Visual inspections of the fire barrier walls, ceilings, and floors will examine any sign of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. The enhanced procedure will include requirements for notification, restoration, and mitigating actions if any fire barrier wall, ceiling or floor fails to meet the acceptance criteria.

This enhancement is acceptable because it will make the program consistent with GALL AMP XI.M26, Element 3, which states that visual inspection will examine fire barrier walls, ceilings, and floors for any sign of degradation like cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. This enhancement is also acceptable for making the program consistent with GALL AMP XI.M26, Element 6, which states that inspection results are acceptable if there are no visual indications of concrete cracking, spalling, and loss of material of fire barrier walls, ceilings, and floors. The staff reviewed the applicant's program procedures for consistency with the GALL Report.

On this basis, the staff finds the enhancement acceptable because the enhanced Fire Protection Program will be consistent with GALL AMP XI.M26 and will add assurance of adequate management of aging effects.

Enhancement 3. The LRA states an enhancement to the GALL Report program elements "parameters monitored/inspected," specifically:

The Program operability test procedure for the diesel-driven fire pump will be enhanced to include a visual inspection of the insulated fuel oil supply piping for signs of leakage.

This enhancement is acceptable because it will make the program consistent with GALL AMP XI.M26, Element 3, which states that observation of the diesel fire pump during performance tests detects any fuel supply line degradation. This enhancement is also acceptable for making the program consistent with GALL AMP XI.M26, Element 6, which states that no corrosion is acceptable in the diesel-driven fire pump fuel supply line. The staff reviewed the applicant's program procedures for consistency with the GALL Report.

On this basis, the staff finds the enhancement acceptable because the enhanced Fire Protection Program will be consistent with GALL AMP XI.M26 and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.2.14 states that the Fire Protection Program is maintained in accordance with HNP engineering program requirements and managed in accordance with plant administrative controls. The applicant stated that the operating history and assessment results for the program show it effectively preserves safe shutdown capability from fire. The applicant further stated that the Fire Protection Program improves continually on the bases of both industry and plant-specific operating experience. Industry operating experience is incorporated into the Fire Protection Program through the Operating Experience Program and through staff generic communications. The program benefits from bench-marking other industry plants. Plant-specific operating experience also improves the Fire Protection Program through the Corrective Action Program and program assessments.

The LRA also states that QA audits and surveillances revealed system equipment in good material condition meeting licensing requirements. The audits and surveillances revealed no issues or findings with impact on program effectiveness to manage aging effects for fire protection components.

In September 2005 the NRC completed a triennial fire protection inspection to assess whether the plant had implemented an adequate fire protection program and whether post-fire safe shutdown capabilities have been established and maintained properly. Results confirmed that plant personnel had maintained the fire protection systems in accordance with an approved fire protection program, detected program deficiencies, and implemented appropriate corrective actions. The inspection team also evaluated the material condition of fire area boundaries, fire doors, and fire dampers and concluded that plant personnel had maintained passive features in a state of readiness. The staff reviewed operating experience and operating experience reports and interviewed the applicant's technical personnel and confirmed that plant-specific operating experience revealed no degradation not bounded by industry experience. The staff also reviewed condition reports for the corrective actions taken for signs of degradation of fire protection components. The staff confirmed that repairs to the degraded fire barriers or by adequate engineering evaluations of their acceptability closed out the condition reports. The staff noted that the applicant's periodic inspections place deficiencies into the corrective action program for timely, appropriate corrective actions.

On the basis of its review of the operating experience and discussions with the applicant's technical personnel, the staff concludes that the applicant's Fire Protection Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.14, the applicant provided the FSAR supplement for the Fire Protection Program. The staff reviewed this section and determines that the information in the FSAR 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 Fire Protection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Fire Water System Program

Summary of Technical Information in the Application. LRA Section B.2.15 describes the existing Fire Water System Program as consistent, with enhancements, with GALL AMP XI.M27, "Fire Water System."

The applicant stated that the Fire Water System Program periodically monitors system pressure, evaluates wall thickness, tests flow and pressure in accordance with National Fire Protection Association commitments, and visually inspects overall system condition. These activities effectively determine whether corrosion and bio-fouling have occurred. Inspections of sprinkler heads assure that corrosion products that could block flow from the sprinkler heads do not accumulate. These measures for timely corrective action for system degradation ensure the capability of the water-based Fire Suppression System to perform its intended function.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it.

The staff also noted no exceptions to GALL AMP XI.M27, "Fire Water System." The staff reviewed the Fire Water System Program for which the applicant claims consistency with GALL AMP XI.M27 and found it consistent. Furthermore, the staff concludes that the applicant's Fire

Water System Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Fire Water System Program consistent with the recommended GALL AMP XI.M27, "Fire Water System," and acceptable with enhancements as described:

Enhancement 1. The LRA states an enhancement to the GALL Report program element "parameters monitored/inspected," specifically:

> Revise the program to incorporate a requirement to perform non-intrusive baseline pipe thickness measurements at various locations, prior to the expiration of current license and trended through the period of extended operation. The plant-specific inspection intervals will be determined by engineering evaluation performed after each inspection of the fire protection piping to detect degradation prior to the loss of intended function.

The staff finds this enhancement acceptable because the enhanced Fire Water System Program will be consistent with GALL AMP XI.M27, Element 4, and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.2.15 states that the Fire Water System Program is maintained in accordance with HNP engineering program requirements for assurance of effective program implementation to meet regulatory and procedural requirements, including periodic reviews. Qualified personnel assigned as program managers have authority and responsibility to implement the program and to commit adequate resources to its activities. The applicant also stated that the operating history and assessment results for the Fire Water System Program show that it effectively preserves safe shutdown capability from fire. These measures assure continual improvement of the program as prompted by industry experience and research and routine program performance and program capability to support plant safety throughout the period of extended operation.

The staff reviewed the operating experience described in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

On September 2005, the staff completed a triennial fire protection inspection for whether the applicant had implemented an adequate fire protection program and established properly maintained post-fire safe shutdown capabilities. Results confirmed that the applicant had maintained the fire protection systems in accordance with an approved fire protection program, detected program deficiencies, and implemented appropriate corrective actions. The inspection team also evaluated the material condition of selected wet pipe sprinkler systems, standpipe systems, and hose reels and concluded that the applicant had maintained passive features in a state of readiness. The staff's QA audit revealed no issues or findings with impact on program effectiveness to manage loss of material for fire water system components.

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.

FSAR Supplement. In LRA Section A.1.1.15, the applicant provided the FSAR supplement for the Fire Water System Program. The staff reviewed this section and determines that the information in the FSAR 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 Fire Water System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that its implementation 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 FSAR 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 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. LRA Section B.2.16 describes the existing Fuel Oil Chemistry Program as consistent, with exceptions and enhancements, with GALL AMP XI.M30, "Fuel Oil Chemistry."

The applicant stated that fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the guidelines of the American Society for Testing and Materials (ASTM) Standards D1796 (as referenced in ASTM D975-81), D2276-78, and D4057-81. The applicant applies the 1983 version of D1796. The ASTM standards are in accordance with the applicant's technical specification surveillance requirements for fuel oil testing. In accordance with industry best practices, HNP periodically tests for the presence of biological growth. Exposure to fuel oil contaminants (*e.g.*, water and microbiological organisms) is minimized by verification of new oil quality and addition of stabilizers before its introduction into the storage tanks and by periodic sampling for whether the tanks are free of water, particulates, and biological growth. Program effectiveness is verified by periodic tank inspections for significant degradation to maintain component intended functions during the period of extended operation.

Staff Evaluation. During its audit and 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, remained adequate to manage the aging effects for which the LRA credits it.

Exception 1. The LRA states an exception to the GALL Report program element "scope of the program," specifically:

> In addition to the aging mechanisms listed in the GALL Report, the HNP Fuel Oil Chemistry Program is credited with managing loss of material due to crevice corrosion. The GALL Report program lists loss of material due to general, pitting, and microbiologically-influenced corrosion.

The staff finds this exception acceptable because the GALL Report already considers the loss of material due to pitting in an environment similar to that which causes crevice corrosion. In addition, the monitoring and inspection methods of the Fuel Oil Chemistry Program are appropriate for detecting crevice corrosion.

Exception 2. The LRA states an exception to the GALL Report program element "scope of the program," specifically:

> In addition to storage tanks, the program is used to manage aging effects on all within scope system components "wetted" by fuel oil. This exception results in additional materials being within scope beyond those in the GALL Report and is considered to be an exception.

The staff finds this exception acceptable because quality control of fuel oil in contact with these surfaces is in the supply tanks by control of its chemistry or by design features. The materials in these additional components, therefore, are not subject to an aggressive environment.

Exception 3. The LRA states exceptions to the GALL Report program element "preventive actions," specifically:

> None of the systems within scope of this program use corrosion inhibitors. Site operating experience does not show adverse trends in corrosion in the fuel oil components. Therefore, corrosion inhibitors are not required.

During the audit and review, the staff noted that HNP actually used corrosion inhibitors in the fuel oil and asked the applicant why it needed this exception.

In its response dated August 20, 2007, the applicant amended the LRA:

> Under the program description section, the sentence starting with 'Exposure to fuel oil contaminants,...' will be changed to say: Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by verifying the quality of new oil and the addition of a stabilizer, which contains a biocide and corrosion inhibitors, before the fuel oil is added to the storage tanks that supply the Emergency Diesel Generator and Security Power Diesel Generator. Continued quality levels are assured by periodically checking for and removing water from tank drains, sampling to confirm that the bulk properties of water and sediment, particulate contamination, and biological growth are within administrative target values or Technical Specification limits.
>
> Under the exceptions section, for the preventive actions, the first sentence has been changed to a Note and the remaining items renumbered. The Note states that: A

stabilizer containing a biocide and corrosion inhibitor is added to new fuel before it is added to the storage tanks in the diesel fuel oil storage and transfer system and the security power system.

The staff finds this response acceptable because with this amendment the applicant's Fuel Oil Chemistry Program in the LRA uses stabilizers with a biocide and corrosion inhibitor consistent with GALL report recommendations and therefore acceptable. The diesel-driven fire pump fuel oil tank does not benefit from the stabilizer with the biocide and corrosion inhibitor. The staff finds this situation acceptable based on a review of plant-specific operating experience and on the fact that the staff confirmed that routine refreshment of this fuel oil replaces fuel oil used during testing. The staff confirmed during the onsite audit that HNP typically replaces the fuel oil in the tank every three years.

Exception 4. The LRA states exceptions to the GALL Report program element "preventive actions," specifically:

> The penetrations for the drain line in the emergency diesel generator day tanks enter the tanks horizontally resulting in water and sediment, if present, remaining on the bottom of the tanks. The day tanks are in the Diesel Generator Building, which has its own HVAC system and, therefore, would not be subject to large temperature swings causing condensation. Frequent checks for water are performed as a result of Technical Specification Surveillance Requirements. The tanks are periodically cleaned to minimize corrosion and biological growth.

During the audit and review, the staff noted that the suction lines for these day tanks are on the tank bottoms and that the monthly operation of the emergency diesel generators confirms whether water and sediment are drawn downstream from the day tanks in any significant quantities. On the bases of the periodic cleaning of the tanks, the low probability of condensation formation in the tanks due to temperature changes, and lack of evidence of water and sediment downstream from the day tanks, the staff finds this exception acceptable.

Exception 5. The LRA states exceptions to the GALL Report program element "preventive actions," specifically:

> The security power system diesel engine (day) tank is sampled at the inlet filter to the engine, which is installed at an elevation above the tank's outlet nozzle. The outlet nozzle is located horizontally at the bottom of the tank; thus, sediment and water may accumulate there. Periodic water removal is not performed. During periodic inspection of the tank, removal of water and sediment will be performed, as practical, given its limited access.

During the audit and review, the staff reviewed plant procedures to confirm that water removal from the main fuel oil tank, which supplies fuel oil to the security power system diesel day tank, minimizes a potential source of water to the day tank. In addition, the staff noted that the day tank is elevated over the main fuel oil tank with the fill line on the day tank bottom to minimize the potential presence of water and sediment. Even though the sample point may not be conducive to the detection of the presence of water and sediment in the day tank fuel oil, the staff finds this exception acceptable based on the configuration of the day tank inlet piping and the periodic inspection and removal of water and sediment from the day tanks by documented plant procedures reviewed during the onsite audit.

Exception 6. The LRA states exceptions to the GALL Report program element "preventive actions," specifically:

> The use of stabilizers in the diesel-driven fire pump fuel oil tank is not warranted, as fuel oil is frequently refreshed. The consumption of fuel oil is the result of the monthly requirement in Fire Protection Program to run the pump for 30 minutes on relief flow. The frequent addition of diesel fuel oil eliminates the need for stabilizers.

During the audit and review, the staff confirmed that HNP replaces the fuel oil in the diesel-driven fire pump fuel oil tanks completely about every three years based on the amount of diesel operation time to support the monthly fire protection requirement. Based on the fact of regular addition of fresh fuel oil to the day tank, the staff finds this exception acceptable.

Exception 7. The LRA states an exception to the GALL Report program element "parameters monitored or inspected, specifically:

> HNP uses the guidance in ASTM D2276-78, Method A, without modification for filter pore size. The filter used is a smaller pore size.

The use of a filter pore size smaller than recommended by the standard will trap more particulates with the result of corrective actions sooner than with the larger filter pore size. Based on the conservative use of filter pore size, the staff finds this exception acceptable.

Exception 8. The LRA states exceptions to the GALL Report program element "detection of aging effects," specifically:

> Multi-level sampling is not performed in the main fuel oil storage tanks, as recommended for the larger fuel oil tanks used in the petroleum industry. Discretion is used at nuclear plants where significantly smaller tanks are used for storage and are not subject to the same degree of heterogeneity.

During the audit and review, the staff reviewed the sampling procedure for the main fuel oil tanks calling for samples from a point in the lower section of the tanks (exhibited on plant drawing 5-G-0063-LR at location XY). Samples from a low point in the tank are conservative as to multi-level sampling for water and sediment, which tend to be present in higher concentrations in the lower sections. The staff finds this method conservative and therefore acceptable for the main diesel fuel oil tanks.

For the security diesel main fuel tank, the staff noted during the audit and review that the sampling used a weighted beaker to take samples from the bottom of the tank where any sediment will accumulate for the detection of corrosion products, microbiological organisms, or water if present. The staff finds use of a weighted sampling beaker conservative as to multi-level sampling and therefore acceptable.

For the diesel-driven fire pump fuel oil storage tank, the staff reviewed the chemistry sampling procedure and noted a weighted beaker also in use to sample fuel oil in this tank. In this case, the sampler fills gradually with the beaker on the bottom of the tank and then the sampler stopper opens gradually as the beaker is pulled to the top of the tank. The staff finds this method similar to multi-level sampling and acceptable as a multi-level method consistent with the GALL Report recommendation.

Based on the preceding facts, the staff finds this exception acceptable because the applicant uses a sampling method equivalent to or more conservative than that recommended by the GALL Report. As noted, the specific sampling method depends on the fuel oil storage tank sampled.

Exception 9. The LRA states exceptions to the GALL Report program element "detection of aging effects," specifically:

> An exception is taken regarding ultrasonic testing of the security power system diesel engine fuel oil tanks. Ultrasonic thickness measurements would only be done for the buried main tank and the (day) tank if visual inspection reveals significant internal damage due to loss of material.

During the audit and review, the staff confirmed that this exception is for both the main fuel oil storage tank and the day tank. The main fuel oil tank is double-walled with the internal surface inspected periodically under this program. If these visual inspections find no evidence of degradation additional ultrasonic thickness measurements are not necessary. The staff finds this exception acceptable based on the alternative indication of degradation by visual inspections, the dual-walled tank design with corrosion-resistant material on the outer liner exposed to soil, and the applicant's commitment to ultrasonic testing if it detects significant degradation. In addition to periodic visual inspections, the day tank receives an external examination under the Structures Monitoring Program. If there is no significant interior or exterior degradation, there is no compelling reason for ultrasonic thickness measurements. On the bases of alternative methods to detect the aging effect and the applicant's commitment to ultrasonic testing if it detects significant degradation, the staff finds this exception acceptable.

Exception 10. The LRA states exceptions to the GALL Report program element "detection of aging effects," specifically:

> An exception is taken regarding ultrasonic testing of the diesel-driven fire pump fuel oil tank. Ultrasonic thickness measurements would only be done for the tank if visual inspection reveals significant internal damage due to loss of material or limited access makes visual inspection unacceptable.

During the audit and review, the staff noted that the applicant has developed an enhancement to remove the sediment from the tank periodically for a visual inspection of the internal surface.

In addition, the staff noted that the External Surfaces Monitoring Program will inspect visually the external surface of this tank mounted above ground. Based on the alternative means to detect surface degradation and the applicant's commitment to testing if it detects significant degradation of the internal or external surfaces, the staff finds this exception acceptable.

Exception 11. The LRA states exceptions to the GALL Report program element "monitoring and trending," specifically:

> Monitoring and trending for biological growth (e.g., microorganisms and algae) in the fuel oil contained within the diesel fuel oil storage tank building tanks will be performed semiannually not quarterly.

As described in the LRA, HNP has developed an enhancement to require for the diesel fuel oil storage tank at least semiannual monitoring and trending of bacterial growth instead of the quarterly monitoring recommended by the GALL Report. This enhancement causes the applicant to take an exception because the frequency is not consistent with that of the GALL Report recommendation.

During the audit and review, the staff noted that plant-specific operating experience shows no biological growth On this basis and because the applicant uses a fuel oil stabilizer with a biocide before adding fuel oil to the storage tanks, the staff finds this exception acceptable.

Exception 12. The LRA states exceptions to the GALL Report program element "monitoring and trending," specifically:

> The security power system buried tank and (day) tank are monitored semiannually, not quarterly.

During the audit and review, the staff asked the applicant to confirm the sampling frequency for the emergency diesel generator and security building diesel generator fuel oil day tanks.

In its response dated August 20, 2007, the applicant clarified its position on sampling frequency by stating that the GALL Report does not address the sampling frequency of the day tanks, which are downstream of the main fuel oil storage tanks; therefore, the applicant considers the frequency and testing of the fuel oil in the day tanks for the emergency diesel generator and security diesel confirmatory to the testing on the main fuel oil tanks. The periodic testing is not an exception for the emergency diesel generator and neither an enhancement nor an exception for the security diesel. In the letter dated August 20, 2007, the applicant amended the LRA to include this information. On the basis that the fuel oil testing is a periodic confirmation of the main tank testing, the staff finds this response acceptable.

Because the GALL Report recommends quarterly testing, the semiannual testing for biological growth in the security diesel buried tank is still an exception that the staff finds acceptable on the bases that plant-specific operating experience shows no evidence of biological growth and that the fuel oil stabilizer added to the fuel oil before it is added to the storage tanks has a biocide.

Exception 13. The LRA states exceptions to the GALL Report program element "monitoring and trending," specifically:

> Testing for biological growth (e.g., microorganisms and algae) in the diesel driven fire pump fuel oil tank will be performed semiannually not quarterly.

The staff finds this exception acceptable on the basis that plant-specific operating experience shows no evidence of biological growth since HNP switched to Grade 1-D fuel oil. Furthermore, under the enhancement for the corrective actions program element, the applicant has committed to initiate a nuclear condition report when biological growth exceeds an administrative limit. The applicant will use this exception for trending purposes and will take appropriate actions to address any detrimental biological growth issues.

Exception 14. The LRA states an exception to the GALL Report program element "acceptance criteria, specifically:

> HNP uses the guidance in ASTM D2276-78, Method A, without modification for filter pore size. The filter used is a smaller pore size.

During the audit and review, the staff confirmed that the applicant uses a filter with a pore size smaller than specified in ASTM D2276-78, Method A, without changing the acceptance criteria. On the basis that the applicant uses a more conservative filter with the same acceptance criteria, the staff finds this exception acceptable.

Enhancement 1. The LRA states an enhancement to the GALL Report program element "scope of the program," specifically:

> Enhance the monitoring procedure for the diesel-driven fire pump fuel oil tank by checking for and removing accumulated water and adding particulate analysis. These activities will be performed quarterly. Additionally, biological growth testing will be added and performed semiannually.

The staff finds the enhancement to check for and remove accumulated water for quarterly particulate analyses consistent with the GALL Report recommendations and therefore acceptable. Evaluation of the semiannual biological growth testing is under Exception 13.

Enhancement 2. The LRA states enhancements to the GALL Report program element "preventive actions," specifically:

> Develop a work activity to periodically clean and inspect the security power system buried fuel tank and (day) tank. Prior to inspection, fuel, water, and sediment will be removed as practical given the limited access in the tank. UT or other NDE will be performed if inspection proves inadequate or indeterminate.

The staff finds this enhancement consistent with GALL Report recommendations and acceptable.

Enhancement 3. The LRA states enhancements to the GALL Report program element "preventive actions," specifically:

> Revise the chemistry sampling procedure for the diesel-driven fire pump fuel oil tank to identify the corrective actions to be taken if a positive result is obtained for biological growth. The appropriate course of action should be taken after the amount and type of biological growth is quantified. The use of biocides will be included as one alternative.

The staff finds this enhancement consistent with GALL Report recommendations and acceptable.

Enhancement 4. The LRA states enhancements to the GALL Report program element "preventive actions," specifically:

> Develop a work activity to inspect the diesel-driven fire pump fuel oil tank. Prior to the inspection, remove fuel, water, and sediment as practical due to the limited access. UT or other NDE will be performed if inspection proves inadequate or indeterminate.

The staff finds this enhancement consistent with GALL Report recommendations and acceptable.

Enhancement 5. The LRA states enhancements to the GALL Report program element "preventive actions," specifically:

> Develop a work activity to periodically check and remove water from the bottom of the diesel-driven fire pump fuel oil tank.

The staff finds this enhancement consistent with GALL Report recommendations and acceptable.

Enhancement 6. The LRA states enhancements to the GALL Report program element “detection of aging effects,” specifically:

> Prior to the period of extended operation and as part of the One-Time Inspection Program, ultrasonic thickness measurements will be taken and compared with previous measurements to confirm the effectiveness of the program in preventing loss of material of the internal surfaces of the diesel fuel oil storage tank building tank liners.

The staff finds this enhancement consistent with the GALL Report recommendations and acceptable.

Enhancement 7. The LRA states enhancements to the GALL Report program element "detection of aging effects," specifically:

> Refer to the enhancements for cleaning and inspecting the security power system buried fuel tank and (day) tank discussed under the "preventive actions" above.

The staff finds this enhancement consistent with the GALL Report recommendations and acceptable.

Enhancement 8. The LRA states enhancements to the GALL Report program element "detection of aging effects," specifically:

> Refer to the enhancements for cleaning and draining water from the diesel-driven fire pump fuel oil tank discussed under the "preventive actions" above.

The staff finds this enhancement consistent with the GALL Report recommendations and acceptable.

Enhancement 9. The LRA states enhancements to the GALL Report program element "monitoring and trending," specifically:

> Revise the Fuel Oil Chemistry Program procedure to require, at least semiannually, monitoring and trending of bacterial growth in the fuel oil contained in the diesel fuel oil storage tank building tanks and semiannual monitoring and trending of particulate contamination and water and sediment in the emergency diesel generator fuel oil day tanks.

During the audit and review, the staff asked the applicant to confirm the sampling frequency for the emergency diesel generator and security building diesel generator fuel oil day tanks.

In its response dated August 20, 2007, the applicant clarified its position on the sampling frequency of the fuel oil day tanks by stating that the GALL Report does not address the sampling frequency of the day tanks, which are downstream of the main fuel oil storage tanks; therefore, the applicant considers the frequency and testing of the fuel oil in the day tanks for the emergency diesel generator and security diesel confirmatory to the testing on the main fuel oil tanks. In the letter dated August 20, 2007, the applicant amended the LRA accordingly to state that the testing of the emergency diesel generator day tanks is confirmatory to the tests on the main storage tanks.

The staff finds the enhancement to require monitoring and trending of bacterial growth, particulate contamination, and water and sediment consistent with the GALL Report and acceptable. The semiannual frequency inconsistent with the GALL Report recommendation is evaluated under Exception 11.

Enhancement 10. The LRA states enhancements to the GALL Report program element "monitoring and trending," specifically:

> For the emergency diesel fuel oil day tanks, establish an appropriate sample point, e.g., in the drain line or pump suction line upstream of piping components such as a filter or pump, and incorporate it into the sampling procedure.

As in Enhancement No. 9, testing of the emergency diesel fuel oil day tanks is confirmatory to the testing on the main storage tanks. On this basis and because the applicant has committed to establishment of an appropriate sample point, the staff finds this enhancement acceptable.

Enhancement 11. The LRA states enhancements to the GALL Report program element "monitoring and trending," specifically:

> Revise the program procedure to require, at least semiannually, monitoring and trending of bacterial growth in the fuel oil contained in the security diesel system buried fuel oil tank. Add a requirement to perform quarterly monitoring and trending for water and sediment and particulates if diesel fuel oil Grade No. 2-D is used.

The staff finds the enhancement to require monitoring and trending of particulate contamination, water, and sediment consistent with the GALL Report and acceptable. The semiannual frequency for trending the bacterial growth is, however, inconsistent with the GALL Report and evaluated under Exception 11. In addition, the enhancement to require quarterly monitoring and trending for water, sediment, and particulates in Grade No. 2-D fuel oil is consistent with the GALL Report and acceptable.

Enhancement 12. The LRA states enhancements to the GALL Report program element "monitoring and trending," specifically:

> Revise the program procedure to require, at least semiannually, monitoring of bacterial growth in the fuel oil contained in the diesel-driven fire pump fuel oil tank, and at least quarterly, monitoring and trending of particulate contamination with appropriate administrative limits. Additionally, for the storage tank, perform quarterly checks for water using the bottom drain line.

The staff finds the monitoring and trending of water and particulate contamination consistent with the GALL Report and acceptable. The semiannual frequency of the monitoring of bacterial growth is, however, inconsistent with the GALL Report and evaluated under Exception 13.

Enhancement 13. The LRA states enhancements to the GALL Report program element "corrective actions," specifically:

> A nuclear condition report will be initiated for trending purposes when an administrative limit is exceeded for water and sediment, particulates, biological growth or when water is drained from a tank. Based on the judgment of the responsible personnel, a nuclear condition report of higher priority may be initiated that requires the cause to be

determined and actions to be taken to prevent recurrence. Additionally, where the program does not specify administrative limits for water and sediment and particulates, appropriate values will be established.

The staff finds this enhancement consistent with GALL Report recommendations and acceptable.

Operating Experience. LRA Section B.2.16 states that the Fuel Oil Chemistry Program is implemented and maintained in accordance with general requirements for the Environmental and Chemistry Sampling and Analysis Program for assurance that the Fuel Oil Chemistry Program effectively meets regulatory and procedural requirements, including periodic assessments and reviews of operating experience.

The applicant stated that the plant condition reports, chemistry results since 2000 for available parameters, and the 10-year emergency diesel generator fuel oil storage tank liner inspection results demonstrate that the Fuel Oil Chemistry Program is monitored critically and improving continually. The applicant further stated that these operating experience results prove that Fuel Oil Chemistry Program practices thus far have ensured the integrity of the subject components.

During the onsite audit, the staff reviewed the fuel oil chemistry data for the years 2000 through 2005 and confirmed that the parameters measured were at or below the limit of unacceptable levels. The data indicated no incident of water contamination in the fuel oil systems. A condition report explained limited data on the diesel-driven fire pump fuel oil tank, indicating inadvertent removal of a chemistry procedure step in testing for viscosity, sediment, and water content every 92 days. Fuel oil testing confirmed acceptable quality and HNP reinstated the missing step into the chemistry procedure.

Condition reports confirmed no failures in the fuel oil system attributed to contamination and the applicant's assertion of no recurrence of biological growth in the security diesel fuel oil tanks since switch to fuel oil Grade 1-D in the mid-1990s. One condition report documented a failure in the fuel oil system buried piping of the 10-year pressure test, indicating that, although not visually inspected, the apparent cause of the failure was exterior corrosion where the coating was defective or damaged in installation. Because of the inaccessible location of this piping, HNP abandoned it in place.

Finally, during the onsite audit, the staff reviewed the emergency diesel generator fuel oil tank inspections during RFO-7 and RFO-13. Inspections of the main fuel oil storage tank liners during RFO-7 revealed minor wall thickness differences from the ultrasonic measurements attributed to installation problems and not to corrosion or material degradation. There was very little ground-side corrosion detected in the bottom plates. These results were after 12 years of service and, except for some minor coating repair in Tank A, there were no signs of degradation on the inside or outside liner surfaces. During RFO-13, internal inspection and cleaning of the emergency diesel day Tank A noted the absence of pitting or general corrosion on the tank bottom. In addition, inspections of the main fuel oil storage tanks revealed an intact coating with no repairs 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.

FSAR Supplement. In LRA Section A.1.1.16, the applicant provided the FSAR supplement for the Fuel Oil Chemistry Program. In a letter dated August 20, 2007, the applicant amended the FSAR description in the LRA to incorporate program description changes and the revision to Commitment No. 12 resulting from the staff's questions during the audit and review. The staff reviewed this section and determines that the information in the FSAR supplement, as amended, 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 Fuel Oil Chemistry Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the exceptions an enhancements (Commitment No. 12 as revised in the letter dated August 20, 2007) and confirmed that their implementation 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 FSAR 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 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. LRA Section B.2.17 describes the existing Reactor Vessel Surveillance Program as consistent, with enhancements, with GALL AMP XI.M31, "Reactor Vessel Surveillance."

The applicant stated that the Reactor Vessel Surveillance Program manages the reduction of fracture toughness of the reactor vessel beltline materials due to neutron embrittlement to fulfill the intent and scope of 10 CFR 50, Appendix H. The program evaluates neutron embrittlement by projecting upper-shelf energy (USE) for all reactor materials with projected neutron exposure greater than 10^{17} n/cm^2 (E>1.0 MeV) after 60 years of operation and with the development of pressure-temperature limit curves. Embrittlement information is obtained from RG 1.99, Revision 2, chemistry tables and from surveillance capsules, which have provided credible data during the current operating period and are expected to provide additional data for the period of extended operation.

The applicant also stated that the surveillance program design, the capsule withdrawal schedule, and the evaluation of test results are in accordance with ASTM E 185-82. As capsules are withdrawn from the reactor vessel, tested specimens are stored for future reconstitution if needed. The program manages the remaining capsules for withdrawal of one capsule when the capsule fluence is equivalent to the 60-year maximum vessel fluence. The two remaining capsules will be managed for optimal neutron exposure and meaningful metallurgical data if additional license renewals are sought. The program manages the steps taken (*e.g.*, the review and updating of 60-year fluence projections to support the preparation of new pressure-temperature limit curves and pressurized thermal shock reference temperature calculations) for altered reactor vessel exposure conditions.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it. The Reactor Vessel Surveillance Program, designed and implemented in accordance with 10 CFR Part 50, Appendix H, tests the reactor vessel surveillance capsule test specimens to monitor for neutron irradiation-induced embrittlement in base metals (plate or forgings) and welds in the beltline region of the low-alloy steel reactor vessel. The Reactor Vessel Surveillance Program has six surveillance capsules, each with mechanical test specimens, Charpy V-Notch specimens, dosimetry, and thermal monitors. The program monitors fracture toughness of beltline materials indirectly through measurement of the impact energy of Charpy V-Notch specimens. The program uses two sets of specimens, one made from representative limiting beltline material, Intermediate Shell Plate Heat Number B4197-2, and the other from a non-limiting beltline circumferential weld (Intermediate Shell to Lower Shell Weld Heat Number 5P6771). To date, HNP has withdrawn and tested three surveillance capsules from the reactor vessel with the remaining three to be exposed to additional neutron flux as a source for future data for management of neutron embrittlement for the period of extended operation.

In response to the request for additional information (RAI) B.2.17, the applicant confirmed by letter dated August 16, 2007, that one of the capsules (Capsule W) scheduled for withdrawal during RFO-16 would be exposed to a maximum neutron fluence equivalent to 55 effective full-power years of reactor vessel operation. Based on the analysis of the capsule withdrawn during RFO-16, the applicant intends to optimize the neutron exposure and withdrawal schedule for the remaining two capsules (standby capsules) to obtain meaningful metallurgical data. The applicant reiterated that it will adjust the withdrawal schedule for one of the standby capsules based on the analysis of the capsule W. To comply with paragraph 7.6.2 of ASTM E-185, the applicant stated, the projected neutron fluence for the next capsule to be withdrawn after RFO-16 will not exceed twice the 60-year maximum reactor vessel fluence. The applicant noted that if the capsule's projected fluence value is excessive, HNP will either relocate it to where it will be exposed to a lower neutron flux or withdraw it for possible future testing or reinsertion. One standby capsule will be available for monitoring of neutron exposure if HNP seeks additional license renewals. The applicant's response to RAI B.2.17 by letter dated August 16, 2007, included the following statement consistent with the applicant's Commitment 13, Item 1;

> The tested and untested specimens from all the capsules pulled from the reactor vessel must be kept in storage to permit future reconstitution use and HNP shall maintain the identity, traceability, and recovery of the capsule specimens throughout testing and storage; therefore, the applicant needs no additional commitment in the LRA.

The staff finds this response acceptable because future capsule testing will reasonably assure effective monitoring of neutron irradiation-induced embrittlement in the reactor vessel beltline materials as a result of any change in projected neutron fluence during the period of extended operation. The staff determined that the applicant's response will be included in the safety evaluation as part of a standard licensing condition.

As to the applicant's plan for the withdrawal of the reactor vessel surveillance capsules, in response to RAI B.2.17 the applicant's letter dated August 16, 2007, stated that it will obtain staff approval when making any changes to the withdrawal schedule. The applicant stated that this response is consistent with the statements in Attachment 3 to the HNP procedure, "Technical Specification Equipment List Program and Core Operating Limits Report." The staff finds this response acceptable provided the applicant includes this response in the LRA commitment table.

After reviewing the applicant's response to the staff's RAI B.2.17, the staff concludes that its concern described in RAI B.2.17 is resolved. The staff accepts the applicant's Reactor Vessel Surveillance Program for the following reasons:

- the testing of the surveillance capsules in accordance with the proposed schedule reasonably assures adequate monitoring of neutron-induced embrittlement in low-alloy steel reactor vessel base metals and their welds during the period of extended operation and

- the applicant's Reactor Vessel Surveillance Program complies with 10 CFR Part 50, Appendix H. The staff confirmed that the applicant's description of the "operating experience" program element satisfies criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10.

The staff finds this program element acceptable.

Operating Experience. LRA Section B.2.17 states that the Reactor Vessel Surveillance Program described in FSAR Section 5.3 has provided materials data and dosimetry for the monitoring of irradiation embrittlement since plant startup. The applicant also noted that the staff has approved use of the program during the period of current operation. A review of NRC information notices, bulletins, and generic letters and the INPO operating experience database found no applicable operating experience with reactor vessel surveillance events since January 2005. The applicant stated that the surveillance capsules have been withdrawn during the period of current operation, and the credible data from these surveillance capsules have verified and predicted reactor vessel beltline material performance as to neutron embrittlement. The applicant noted that the calculations as required have projected the degree of USE reduction expected to result from future neutron exposure, including 60-year projections. Pressure-temperature limits imposed on operational parameters assure vessel operation within required safety margins. Three capsules remain inside the reactor vessel exposed to additional neutron flux as a source for future data for management of neutron embrittlement aging effects 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.

FSAR Supplement. In LRA Section A.1.1.17, the applicant provided the FSAR supplement for the Reactor Vessel Surveillance Program. The staff reviewed this section and determines that the information in the FSAR 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 Reactor Vessel Surveillance Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation 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 FSAR 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 Selective Leaching of Materials Program

Summary of Technical Information in the Application. LRA Section B.2.19 describes the new Selective Leaching of Materials Program as consistent, with exceptions, with GALL AMP XI.M33, "Selective Leaching of Materials Program."

The applicant stated that the selective Leaching of Materials Program ensures the integrity of components and commodities (*e.g.*, piping, pump casings, valve bodies and heat exchanger components) made of copper alloys with zinc content greater than 15 percent and gray cast iron exposed to raw water, treated water, lubricating oil or hydraulic fluid, fuel oil, wetted air/gas, or soil environments. A new inspection procedure will define one-time examination methodology and acceptance criteria. The program will be implemented by the work management process with a qualitative determination of selected components that may be susceptible to selective leaching. Confirmation of selective leaching may be by metallurgical evaluation or other testing methods.

The applicant also stated that the examinations will determine whether loss of material due to selective leaching has occurred and whether the process will affect component ability to perform intended function(s) for the period of extended operation. A sample population will be selected for the inspections to be completed prior to the period of extended operation. Evidence of selective leaching will result in expanded sampling as appropriate and an engineering evaluation.

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

Exception. The LRA states the following exception to the GALL Report program elements "scope of the program," "parameters monitored or inspected," and "detection of aging effects, specifically:

> The exception involves the use of examinations, other than Brinell hardness testing identified in the GALL Report, to identify the presence of selective leaching. A qualitative determination of selective leaching will be used in lieu of Brinell hardness testing for components within the scope of this program. The exception is justified, because (1) Brinell hardness testing may not be feasible for most components due to form and configuration (i.e., heat exchanger tubes) and (2) other mechanical means, i.e., scraping or chipping, provide an equally valid method of identification.

In a letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 15) to implement the program with the exception to the stated program elements. During the audit and review, the staff discussed the exception with the applicant to clarify the use of qualitative methods of determination in lieu of Brinell hardness testing. The applicant stated that mechanical means (*e.g.*, scraping or chipping) would be a valid method for selective leaching. The staff finds this exception acceptable because these qualitative mechanistic techniques can detect selective leaching and are in use in addition to visual inspections as recommended by the GALL Report; therefore the program will address GALL Report recommendations and be consistent with the "scope of the program," "parameters monitored or inspected," and "detection of aging effects" program elements.

Operating Experience. LRA Section B.2.19 states that operating experience to verify the effectiveness of the new Selective Leaching of Materials Program is not available. Plant-specific operating experience shows no occurrences of selective leaching of materials.

During the audit and review, the staff asked the applicant how it records operating experience. The applicant indicated that the Corrective Action Program tracks and trends plant-specific operating experience for components managed by the Selective Leaching of Materials Program and documents any degraded or potentially unable to fulfill intended functions for evaluation by engineering personnel for extent of condition and appropriate follow-up actions. The evaluation would note adverse trends and include industry operating experience.

On the basis of its discussions with the applicant's technical personnel, the staff finds that the applicant's Selective Leaching of Materials Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.19, the applicant provided the FSAR supplement for the Selective Leaching of Materials Program and, by letter dated August 20, 2007, Commitment No. 15 to implement the Selective Leaching of Materials Program prior to the period of extended operation. The staff reviewed this section and determines that, with Commitment

No. 15, the information in the FSAR 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 Selective Leaching of Materials 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 concludes that the applicant has demonstrated that, with Commitment No. 15, 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 FSAR 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 One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program

Summary of Technical Information in the Application. LRA Section B.2.21 describes the new One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program as consistent, with exceptions, with GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping."

The applicant stated that the industry has experienced cracking of small-bore piping from thermal and mechanical loading and intergranular stress corrosion. Specific industry events include cracking caused by fatigue due to thermal stratification resulting in the issuance of Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant System" (as supplemented). The applicant also noted that ASME Code does not currently require volumetric examination of Class 1 small-bore piping; however, as stated in GALL Report Section XI.M35, the staff believes that the inspection of small-bore Class 1 piping (less than nominal pipe size (NPS) 4) should include volumetric examinations to detect cracking. The One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will manage this aging effect by volumetric examinations except for small-bore socket-welds. In lieu of volumetric inspections of socket welds, the program will include one-time volumetric examinations of samples of Class 1 butt welds for pipe less than NPS 4. The applicant further stated that the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will manage cracking in small-bore piping (less than NPS 4) to maintain the system intended function and prevent loss of reactor coolant system pressure boundary through the period of extended operation. This program will be implemented and inspections completed and evaluated prior to the period of extended operation.

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

The staff interviewed the applicant's technical personnel and reviewed the applicant's license renewal basis documents for the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program, including the license renewal basis calculation assessing consistency of the program elements with the program element criteria recommended in GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping." Specifically, the staff reviewed the program elements (documented in SER Section 3.0.2.1) in the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program license renewal basis calculation and its basis documents, as listed in the Audit Report, for whether the program elements are consistent with the programmatic criteria defined and recommended in the program elements of GALL AMP XI.M35.

From its review of the license renewal basis calculation, the staff verified that the specific One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program is a specific one-time inspection program for small-bore piping in the reactor coolant pressure boundary and that the program credits one-time volumetric examinations of the ASME Code Class 1 small-bore piping to confirm whether cracking from either stress corrosion cracking or cyclical loading is an aging effect requiring augmented management (*i.e.*, to confirm whether an augmented periodic inspection program is needed for small-bore piping during the period of extended operation). The staff also verified that the program elements for the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program were consistent with the criteria recommended in the program elements of GALL AMP XI.M35," One-Time Inspection of ASME Code Class 1 Small-Bore Piping," with the following exception evaluated in the following paragraphs:

Exception. The LRA states that the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program includes the following exception to the "detection of aging effects" and "monitoring and trending" program elements of GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping":

> The HNP One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will manage this aging effect through the use of volumetric examinations with the exception that volumetric examinations for small-bore socket-welds will not be done. The current state of technology provides no effective, reliable method of performing volumetric examinations of small-bore socket welds. In lieu of performing volumetric inspections of socket welds, the program will include one-time volumetric examinations of a sample of Class 1 butt welds for pipe less than NPS 4. The sample population for volumetric inspections will be at least 10 percent or will otherwise be based on a risk-informed inspection plan approved by the NRC. The volumetric inspections will be completed prior to the end of, and within the last five years of, the current operating period. In addition, the program will include controls to ensure the 100 percent of all ASME Class 1 socket welds NPS 2 and smaller receive a VT-2 visual inspection each refueling outage in accordance with the approved ASME Section XI ISI program. Any cracking identified in small-bore Class 1 piping determined to be attributable to stress corrosion or thermal and mechanical loading will result in periodic inspections.

The "detection of aging effect" program element of GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Piping," recommends a one-time volumetric inspection on a sample of the facility's ASME Code Class 1 small bore piping welds for whether cracking is an AERM by an augmented periodic-inspection program for small-bore piping. The "monitoring and trending" program element of GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Piping," recommends a sample size for these one-time volumetric inspections based on component susceptibility, inspectability, dose, operating experience, and limiting location considerations.

During the audit, the staff asked the applicant to clarify its regulatory basis for one-time inspections of the ASME Code Class 1 small-bore socket welds and to justify its selections of sample size and components.

In its response dated August 20, 2007, the applicant stated:

> ASME Section XI currently requires a pressure test at the end of each refueling outage on all Class 1 socket welds. VT-2 visual examinations are performed at that time. Currently, Section XI requires a surface examination of selected Class 1 socket welds. HNP will follow Section XI and NRC requirements for socket welds during the period of extended operation.
>
> Consistent with GALL, inspections will be performed at a sufficient number of locations to assure an adequate sample. The sample size for the plant-specific program will be based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small bore piping locations. The sample prioritization will consider the potential for mechanical loading as a result of thermal stratification, piping potentially susceptible to IGSCC (normally stagnant piping), and locations identified for inspection under the RI-ISI program (which considers thermal loading from plant cycles and thermal stratification).

The applicant's license renewal basis calculation for the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program, as modified by the information in the applicant's letter of August 20, 2007, indicates that the applicant uses the following bases for this program:

- The applicant will complete one-time volumetric examinations of a sample of ASME Code Class 1 small-bore pipe full-penetration butt welds prior to the period of extended operation.

The applicant's basis for volumetric examinations of the ASME Code Class 1 small-bore full penetration welds is consistent with the recommended criteria in the "detection of aging effects" program element of GALL AMP XI.M35 and acceptable.

- The applicant will complete the VT-2 visual examinations required by the ASME Code Section XI, Table IWB-2500-1, Examination Category B-P (every refueling outage), and the surface examinations required for ASME Code Class 1 small-bore socket welds in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-J, Inspection Item B9.40 (once every 10-year ISI interval), as the basis for inspection of the ASME Code Class 1 small-bore socket welds within the scope of this AMP. The visual examinations will detect system leakage from these components during each scheduled RFO. The surface examinations will detect surface-breaking flaws on the socket welds.

Based on this assessment, the staff concludes that this basis is acceptable because the applicant's periodic surface examinations of ASME Code Class 1 small-bore socket welds will be in accordance with ASME Code Section XI and because these examinations will be sufficient to detect surface-breaking flaws in the socket welds prior to any component failure

- The applicant will base the sample size for the one-time examinations of the small-bore full-penetration butt welds on susceptibility, inspectability, dose considerations, operating experience, and accessibility considerations. The applicant's bases for selecting the sample size and the specific component locations for volumetric examination are consistent with the criteria recommended in the "monitoring and trending" program element of GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small Bore Piping."

Based on this assessment the staff concludes that bases for selecting the sample size and components for inspection are consistent with the corresponding recommendations in GALL AMP XI.M35 and acceptable.

The staff also reviewed the portions of the applicant's One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program for which the applicant claimed consistency with GALL AMP XI.M35 and determined that they were consistent with the remaining program element criteria of GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping."

The staff also verified the applicant's incorporation of its need to implement the One-Time Inspection of ASME Code Class 1 Small-bore Piping Program prior to the period of extended operation as LRA Commitment No. 17 docketed in the applicant's letter of August 20, 2007.

On the basis of its review, the staff concludes that the applicant's One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program is consistent with the recommended program elements in GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping," with the exception that the applicant has an acceptable basis for using the required examinations of the ASME Code Section XI for its ASME Code Class 1 small-bore socket welds during the period of extended operation. Based on this assessment, the staff concludes that the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program, with the applicant's commitment to implement this program prior to the period of extended operation, provides assurance that either aging of small-bore ASME Code Class 1 piping has not occurred or is so insignificant that a periodic, inspection-based AMP is not warranted for these components.

<u>Operating Experience</u>. LRA Section B.2.21 states that this new AMP for the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program has no operating experience to verify its effectiveness. Any future operating experience which may impact the program will be reviewed through the normal screening process for applicability. This process will continue through the period of extended operation.

During the audit, the staff asked the applicant for plant-specific operating experience and the schedule for the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program.

In its response dated August 20, 2007, the applicant stated that there is no plant-specific operating experience for the new One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program and that this program will be implemented prior to the period of extended operation.

LRA Section B.2.21 also states that there is no operating experience to validate the effectiveness of this new One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program. The normal operating experience review process will screen for applicability and record any future operating experience which may impact the program. This process will continue through the period of extend operation. The LRA states in Commitment No. 17 that this program will be implemented prior to the period of extended operation.

On the basis of this review, the staff concludes that (1) the applicant's One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program includes no operating experience with degradation of ASME Code Class 1 small-bore piping because this new program has not been implemented at the facility, (2) the applicant's implementation of this program in Commitment No. 17 will assess and correct any recordable indications of age-related degradation in the ASME Code Class 1 small-bore piping adequately before returning the affected components to service, and (3) the applicant will evaluate the need for an augmented periodic-inspection program for small-bore piping if it detects any indications of age-related degradation in the small-bore piping while implementing this AMP.

FSAR Supplement. In LRA Section A.1.1.21, the applicant provided the FSAR supplement for the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program. The staff reviewed this section and determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff has verified that the applicant has reflected its need to implement the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program prior to the period of extended operation in LRA Commitment No. 17 docketed in the applicant's letter of dated August 20, 2007, and that this commitment refers to the FSAR supplement for the AMP in LRA Section A.1.1.21.

Based on this review, the staff concludes that the FSAR supplement for this AMP describes the program adequately and an appropriate commitment in the LRA reflects the need to implement the program.

Conclusion. On the basis of its audit and review of the applicant's One-Time Inspection of ASME Code Class 1 Small-Bore Piping 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 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 FSAR 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 External Surfaces Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.22 describes the existing External Surfaces Monitoring Program as consistent, with enhancements, with GALL AMP XI.M36, "External Surfaces Monitoring."

The applicant stated that the External Surfaces Monitoring Program based on system inspections and walkdowns consists of periodic visual inspections of components (*e.g.*, piping, piping components, ducting) and other equipment within the scope of license renewal and subject to an AMR in order to manage aging effects. The External Surfaces Monitoring Program includes inspections and evaluations by engineering personnel and directs thorough and consistent inspection of SSCs by criteria that focus on detection of aging effects. The program manages aging effects through visual inspection of external surfaces. Loss of material due to boric acid corrosion is managed by the Boric Acid Corrosion Program. Surfaces inaccessible during plant operations are inspected during refueling outages. The applicant further stated that the surfaces inaccessible during both plant operations and refueling outages are inspected at frequencies for reasonable assurance of management of the effects of aging so components perform intended functions during the period of extended operation.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it.

The staff interviewed the applicant's technical personnel and reviewed the applicant's license renewal basis calculation for the External Surfaces Monitoring Program assessing program consistency with GALL AMP XI.M36, "External Surfaces Monitoring." Specifically, the staff reviewed the program elements (SER Section 3.0.2.1) of the External Surfaces Monitoring Program and its basis documents, as listed in the Audit Report, for consistency with program element criteria defined and recommended in GALL AMP XI.M36. The staff also reviewed the enhancements and the justifications for whether the AMP with the enhancements remains adequate to manage the aging effects for which the LRA credits it. From its review of the license renewal basis calculation and its basis documents, the staff determined that the applicant credits this program and visual examinations to manage loss of material from the external surfaces of steel components for which the AMP is credited subject to the following enhancements to make the program consistent with the program element criteria recommended in GALL AMP XI.M36, "External Surfaces Monitoring." Based on this determination, the staff found the program elements for the External Surfaces Monitoring Program consistent with the program element criteria defined and recommended in GALL AMP XI.M36, "External Surfaces Monitoring," subject to enhancements evaluated in the following paragraphs:

The LRA states that the External Surfaces Monitoring Program will be enhanced prior to the period of extended operation, as specified in Enhancements 1, 2, and 3:

Enhancement 1. The LRA states the "scope of program" program element for the External Surfaces Monitoring Program will be enhanced as follows:

A specific list of systems managed by the program will be added to the program document. Specific guidance will be provided for insulated/jacketed pipe and piping components to evaluate the integrity of the covering for signs of leakage and the environmental conditions (moist/wet) to determine whether insulation should be removed to inspect for corrosion.

The "scope of program" program element in GALL AMP XI.M36, "External Surfaces Monitoring," recommends that the program visually inspect and monitor the external surfaces of steel components in systems within the scope of license renewal and subject to an AMR for loss of material and leakage. The staff noted that the "scope of program" program element for the Externals Surfaces Monitoring Program did not specify steel components within its scope; therefore, the staff concluded that it was necessary and appropriate for the applicant to enhance the "scope of program" program element to specify such components.

The staff verified the applicant's incorporation of this enhancement as Items (1) and (2) of LRA Commitment No. 18 docketed in the applicant's letter of August 20, 2007; thus, the staff concludes that this program enhancement will make the "scope of program" program element consistent with the corresponding program element of GALL AMP XI.M36, "External Surfaces Monitoring," because the enhancement will update the program to specify components within its scope. Based on this conclusion the staff finds this program enhancement acceptable.

Enhancement 2.The LRA states the "detection of aging effects" program element for the External Surfaces Monitoring Program will be enhanced as follows:

Components and structures of the system that are inaccessible or not readily visible during both plant operations and refueling outages are to be inspected at such intervals that would provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation.

Specific guidance will be provided for visual inspections of elastomers for cracking, chafing, or changes in material properties due to wear.

The staff noted that the "detection of aging effects" program element for the Externals Surfaces Monitoring Program did not describe the applicant's activities to manage loss of material in inaccessible components or define specific guidelines for visual inspection of elastomers for cracking, chaffing, or changes in material properties due to wear; therefore, the staff concluded that it was necessary and appropriate for the applicant to enhance the "detection of aging effects" program element of the External Surfaces Monitoring Program to describe these activities.

The staff verified the applicant's incorporation of these enhancements as items (3) and (4) of LRA Commitment No. 18 docketed in the applicant's letter of August 20, 2007. The enhancement will update the program to describe activities for components inaccessible or not readily accessible during plant operations and guidance for visual examinations of elastomeric components with the scope of the AMP. Thus, the staff concludes that these enhancements will make the "detection of aging effects" program element of the External Surfaces Monitoring Program consistent with the "detection of aging effects" program element criteria recommended in GALL AMP XI.M36, "External Surfaces Monitoring."

Enhancement 3. The LRA states the "acceptance criteria" program element of the External Surfaces Monitoring Program will be enhanced as follows:

> The program will incorporate a checklist for evaluating inspection findings, with qualified dispositions. The program will define when corrective action is required. Unacceptable findings will have a condition report initiated and will be handled under the Corrective Action Program.

The "acceptance criteria" program element in GALL AMP XI.M36, "External Surfaces Monitoring," recommends acceptance criteria defined for each component/aging effect combination monitored by the AMP to detect the need for corrective actions before loss of intended functions and design standards, procedural requirements, current licensing bases, industry codes or standards, and engineering evaluations as acceptable source documents for defining what such acceptance criteria should be. The staff noted that the "acceptance criteria" program element of the Externals Surfaces Monitoring Program did not define acceptance criteria specifically; therefore, the staff concluded that it was necessary and appropriate for the applicant to enhance the "acceptance criteria" program element to define acceptance criteria and to state that the program would take corrective actions if the acceptance criteria are exceeded.

The staff verified the applicant's incorporation of these enhancements as Item (5), as stated in LRA Commitment No. 18. Thus, the staff concludes that these enhancements will make the "acceptance criteria" program element for the External Surfaces Monitoring Program consistent with the "detection of aging effects" program element criteria recommended in GALL AMP XI.M36, "External Surfaces Monitoring," because the enhancement will update the program specifically to define acceptance criteria for each component/aging effect combination for which the program monitors and to state that it would take corrective action if these acceptance criteria are exceeded.

On this basis of this review, the staff finds these enhancements acceptable because, when implemented, the External Surfaces Monitoring Program will be consistent with GALL AMP XI.M36 and will assure adequate management of the effects of aging. The staff also reviewed the portions of the applicant's External Surfaces Monitoring Program for which the applicant claimed consistency with GALL AMP XI.M36 and verified their consistency with program element criteria of GALL AMP XI.M36, "External Surfaces Monitoring."

On the basis of its review, the staff concludes that the applicant's External Surfaces Monitoring Program, as enhanced in Commitment No. 18, will make the program consistent with GALL AMP XI.M36, "Externals Surfaces Monitoring," and that the program assures adequate management of aging effects during the period of extended operation.

Operating Experience. LRA Section B.2.22 states that system inspection requirements in effect have been effective in maintaining the material condition of plant systems with a significant number of corrective actions processed as results of system engineer walkdowns. The External Surfaces Monitoring Program will be re-assessed and upgraded based on industry and plant-specific operating experience.

The staff reviewed the operating experience described in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience is not bounded by industry operating experience. In addition, the staff finds that the corrective action program, which records plant-specific and industry operating experience, will review and incorporate future operating experience for objective evidence of adequate management of the effects of aging.

The staff asked the applicant for any plant-specific operating experience information for the External Surfaces Monitoring Program with emphasis on component condition when observed during system walkdowns or maintenance.

The staff reviewed two action requests for components within the scope of the Inspection of External Surfaces Monitoring Program: (1) one (dated March 12, 1997) for degradation detected in the Chilled Water System and (2) another (dated February 4, 2004) for corrosion detected in the traveling screen baskets of the emergency service water system. The staff determined that the applicant's root cause analyses of the degradation described in these action reports and actions to repair or replace the impacted components prior to returning them to service had been appropriate. Based on this determination, the staff concluded that the applicant has taken appropriate action to correct any previous degradation detected in components within the scope of this AMP.

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.

FSAR Supplement. In LRA Section A.1.1.22, the applicant provided the FSAR supplement for the External Surfaces Monitoring Program. The staff reviewed this section and determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff confirmed that the applicant reflected its need to implement the External Surfaces Monitoring prior to the period of extended operation in LRA Commitment No. 18. This commitment refers to the FSAR supplement section for the AMP in LRA Section A.1.1.22. Based on this review, the staff concludes that the FSAR supplement for this AMP is acceptable because it describes the program adequately and because an appropriate commitment in the LRA reflects the need to implement the program.

Conclusion. On the basis of its audit and review of the applicant's External Surfaces Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation 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 FSAR 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 Flux Thimble Tube Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.23 describes the existing Flux Thimble Tube Inspection Program as consistent, with enhancements, with GALL AMP XI.M37, "Flux Thimble Tube Inspection Program."

The applicant stated that the Flux Thimble Tube Inspection Program monitors for thinning of the flux thimble tube wall, which provides a path for the incore neutron flux monitoring system detectors and forms part of the RCS pressure boundary. Flux thimble tubes are subject to loss of material at certain locations in the reactor vessel where flow-induced fretting causes wear at discontinuities in the path from the reactor vessel instrument nozzle to the fuel assembly instrument guide tube. The applicant also stated that Industry experience with thimble tube thinning led to issuance of Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors." In response to the NRC Bulletin, HNP has established a Flux Thimble Tube Inspection Program to monitor for thinning of the flux thimble tube walls. The program uses eddy current testing to monitor for wear. Plant-specific test results are evaluated to determine the wear rate by the methodology outlined in Westinghouse Commercial Atomic Power (WCAP)-12866, "Bottom Mounted Instrumentation Flux Thimble Wear." With the wear rate established, wear predictions are calculated by the WCAP-12866 methodology. The applicant further stated that it then uses wear predictions to determine an adequate inspection frequency. The acceptance criteria for finding unacceptable flux thimbles include an allowance to account for instrument inaccuracies.

The Flux Thimble Tube Inspection Program manages loss of material due to wear to maintain system intended function to prevent loss of reactor coolant system pressure boundary through the period of extended operation.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it.

Enhancement 1. The LRA states the following enhancements to the GALL Report program element "monitoring and trending," specifically:

> Subsequent to each inspection, the latest test results will be evaluated against the historical test results in order to determine a plant-specific value for "n" (wear curve exponent). If the generic value of 0.67 is used for "n," a basis must be provided for using the generic value in lieu of plant-specific data.

During the audit and review, the staff noted that use of a generic wear curve exponent is inconsistent with the GALL Report because a basis is needed for use of the generic value in lieu of plant-specific data. The staff asked the applicant to explain its use of the generic value.

In the same August 20, 2007 letter, the applicant proposed to amend the "monitoring and trending" program element in Enhancement 1 in LRA Section B.2.23 to delete the use of the generic value of 0.67 as "n."

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 19) to enhance the program to require an evaluation of historic plant-specific test data to ensure use of conservative wear rates. The staff finds this commitment acceptable, along with the proposed LRA supplement that restricts use of the generic wear rate without a basis, because the enhanced program implementing procedures will follow the recommendations and be consistent with the "monitoring and trending" program element of the GALL Report.

Enhancement 2. The LRA states the following enhancement to the GALL Report program element "monitoring and trending," specifically:

> The program engineer may deem it unnecessary to perform a 100 percent inspection of all uncapped flux thimbles during each scheduled inspection. Such a decision may be due to thimbles that have been recently replaced or thimbles that are in locations with historically low wear rates. Since plant-specific test data is necessary to determine wear rates used to predict future wear, the program procedure is to be revised to require an evaluation and basis for each flux thimble not inspected.

The applicant proposed a commitment (Commitment No. 19) to enhance the program implementing procedure to authorize the program engineer to determine which uncapped thimbles recently replaced or located in positions with historically low wear rates would need no inspection if review of plant-specific data and an evaluation document the basis for no inspection. The applicant stated its commitment is consistent with the methodology of WCAP-12866. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "monitoring and trending" program element of the GALL Report.

Enhancement 3. The LRA states the following enhancements to the GALL Report program element "monitoring and trending," specifically:

> Plant-specific test data should be used to validate the wear curve exponent. The program procedure is to be revised to require an assessment of actual test results to determine if the assumed wear rate is conservative. This includes a comparison of the actual test results with the predicted wear.

The applicant proposed a commitment (Commitment No. 19) to enhance the program implementing procedure to require an assessment of actual test results for whether the assumed wear rate is conservative. The applicant stated its commitment is consistent with the methodology of WCAP-12866. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "monitoring and trending" program element.

Enhancement 4. The LRA states the following enhancements to the GALL Report program element "acceptance criteria," specifically:

> The procedure governing the program does not directly address the requirements for test results showing an actual wear depth of greater than 70 percent. However, it requires replacement or isolation of any thimble not meeting the acceptance criteria. Therefore, the procedure indirectly requires any thimble with over 70 percent wear to be replaced or isolated. In order to clarify this requirement, the acceptance criteria of the procedure should be changed to require replacement or capping for any thimble with actual wear greater than 70 percent (instead of 80 percent).

The applicant proposed a commitment (Commitment No. 19) to enhance the program implementing procedure to require replacement or capping of any thimble with actual wear greater than 70 percent (instead of 80 percent). The applicant stated its commitment is consistent with the methodology of WCAP-12866. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "acceptance criteria" program element.

Enhancement 5. The LRA states the following enhancements to the GALL Report program element "acceptance criteria," specifically:

> The program procedure currently states that thimbles which have a predicted wear of less than 70 percent 'are acceptable for another fuel cycle operation.' This suggests that evaluation may only consider inspection frequencies of one fuel cycle (18 months). This requirement should be re-worded to state that thimbles meeting this criterion 'are acceptable until the next scheduled inspection.'

The applicant proposed a commitment (Commitment No. 19) to enhance the program implementing procedure to specify that thimbles with predicted wear of less than 70 percent are acceptable until the next scheduled inspection instead of another complete fuel cycle operation. The applicant stated its commitment is consistent with the methodology of WCAP-12866. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "acceptance criteria" program element.

Enhancement 6. The LRA states the following enhancements to the GALL Report program element "corrective actions," specifically:

> Add a requirement to provide a disposition and basis for thimbles that could not be inspected due to restriction, defect or other reason. Thimbles which cannot be shown by analysis to be satisfactory for continued service must be removed from service and replaced or capped to ensure the integrity of the reactor coolant system pressure boundary.

The applicant proposed a commitment (Commitment No. 19) to enhance the program implementing procedure with a disposition and basis for thimbles that cannot be inspected due to restriction, defect, or other reason. The applicant stated its commitment is consistent with the methodology of WCAP-12866. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "corrective actions" program element.

Enhancement 7. The LRA states the following enhancements to the GALL Report program element "corrective actions," specifically:

> Add a requirement for test results and evaluations of test results to be sent to Document Services to be filed as QA records.

The applicant proposed a commitment (Commitment No. 19) to enhance the program implementing procedure to retain test results and their evaluations as QA records. The applicant stated its commitment is consistent with the methodology of WCAP-12866. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "corrective actions" program element.

Operating Experience. LRA Section B.2.23 states that industry experience with thimble tube thinning was initially communicated from the staff by Information Notice 87-44, "Thimble Tube Thinning in Westinghouse Reactors" (as supplemented), and Bulletin 88-09.

As stated in Bulletin 88-09 and in GALL Report Section XI.M37, "the only effective method for determining thimble tube integrity is through inspections which are adjusted to account for plant-specific wear patterns and history;" therefore, the Flux Thimble Tube Inspection Program focuses on plant-specific wear data rather than industry data.

The Flux Thimble Inspection program does not rely on preventive measures to manage the effects of wear. Wear is expected to occur and managed by monitoring and acting to prevent loss of the reactor coolant system pressure boundary. As results of flux thimble inspections, several thimbles have been replaced. A staff search of corrective action items and discussion with the program engineer found no history of through-wall leaks of flux thimbles at HNP.

During the audit and review, the staff reviewed the results from the most recent flux thimble inspections and their evaluations. The inspection results indicated no actual flux thimble tube wear outside of predicted values.

On the basis of its review of plant-specific operating experience and discussions with the applicant's technical personnel, the staff finds that the applicant's Flux Thimble Inspection Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.23, the applicant provided the FSAR supplement for the Flux Thimble Tube Inspection Program. By letter dated August 20, 2007, the applicant proposed Commitment No. 19 to enhance the Flux Thimble Tube Inspection Program prior to the period of extended operation. The staff reviewed this section and determines that, with Commitment No. 19, the information in the FSAR 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 Flux Thimble Tube Inspection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 19 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 FSAR 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 Lubricating Oil Analysis Program

Summary of Technical Information in the Application. LRA Section B.2.25 describes the existing Lubricating Oil Analysis Program as consistent, with enhancement, with GALL AMP XI.M39, "Lubricating Oil Analysis."

The applicant stated that the purpose of the Lubricating Oil Analysis Program is to maintain the oil environment in mechanical systems to the required quality. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. Lubricating oil testing includes sampling and analysis for detrimental contaminants.

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, remained adequate to manage the aging effects for which the LRA credits it.

Enhancement 1. The LRA states the following enhancement to the GALL Report program element "parameters monitored or inspected," specifically:

> Ensure by revising program control and implementing documents as needed that used oil from appropriate component types listed within the scope of license renewal are analyzed to determine particle count and moisture, and if oil is not changed in accordance with the component manufacturer's recommendation, then additional analyses for viscosity, neutralization number, and flash point will be performed. During

oil changes, used oil is drained and visually checked for water. This is done to detect evidence of abnormal wear rates, contamination by moisture, or corrosion.

During the audit and review, the staff reviewed the preventive maintenance procedures that implement the Lubricating Oil Analysis Program and confirmed that they require only a visual check for water at the time of sampling and no checks of diesel lubricating oils for particle count, moisture, and neutrality. This enhancement will require the GALL Report recommended testing for particle count and moisture for lubricating oils in components within the scope of license renewal and additional analyses for viscosity, neutralization and flash point for oil not changed in accordance with the manufacturer's recommendation. Finally, during oil changes, the used oil will be checked visually for water.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 21) to implement this enhancement prior to the period of extended operation. Based on the review of this commitment, the staff finds this enhancement acceptable because with Commitment No. 21, the Lubricating Oil Analysis Program will be consistent with the GALL Report recommendations for the "parameters monitored or inspected" program element.

Enhancement 2. The LRA states the following enhancement to the GALL Report program element "parameters monitored or inspected," specifically:

> Program procedures will be enhanced to include a requirement to perform ferrography or elemental analysis to identify wear particles or products of corrosion when particle count exceeds an established level or when considered appropriate.

During the audit and review, the staff confirmed that analytical ferrography proceeded only when deemed appropriate by the maintenance specialist or after an unusual spike in particle count. This enhancement will require this analysis whenever the particle count exceeds an established limit or whenever deemed appropriate by the specialist.

By letter dated August 20, 2007, the applicant proposed Commitment No. 21 to implement this enhancement prior to the period of extended operation. The staff finds this enhancement acceptable because, with Commitment No. 21, the Lubricating Oil Analysis Program will be consistent with the GALL Report recommendations for the "parameters monitored or inspected" program element.

During the audit and review, the staff reviewed the current preventive maintenance procedures and confirmed periodic sampling of the lubricating oil and adoption of acceptance criteria from industry or manufacturer recommendations. The staff also confirmed comparison of the data to limits established by manufacturer and baseline values for each component. Specialists review and trend results communicate recommendations for appropriate actions to responsible system engineers.

Operating Experience. LRA Section B.2.25 states that operating history over a 10-year period and operating experience data between 1999 and 2005 showed no failures attributed to lubricating oil contamination. The applicant stated that the Lubricating Oil Analysis Program has managed aging effects for components wetted by lubricating oil effectively and has been improved through evaluation of plant-specific and industry operating experience.

During the audit and review, the staff reviewed selected action request corrective action program documents and confirmed that the existing program had detected lubricating oil problems in various components and taken appropriate actions. In all cases, there were no component failures attributed to aging effects. In addition, during the audit and review, the staff reviewed a sample of equipment assessment entries in the plant database from 9/23/2002 to 5/15/2006. The sample assessed lubricating oil contamination events, pressure boundary failures due to corrosion, reductions in heat transfer due to lubricating oil side fouling, or component failures attributed to contamination or changes in lubricating oil properties. This information, the result of either periodic oil sample analyses or oil samples taken as diagnostic tools for anomalous equipment vibration levels, indicated that the program detected oil contamination issues and took appropriate actions to prevent equipment failures. The staff noted that the data showed no failures attributed to lubricating oil issues.

Finally, the staff reviewed a self-assessment report developed by HNP personnel after a benchmarking visit to Palo Verde Nuclear Generating Station and an industry oil analysis training course. The lubricating oil program engineer concluded that there were some gaps in the Lubricating Oil Analysis Program as to current industry practice. The self-assessment established action items to address these gaps, five weaknesses and one item for management attention, although the program was effective and had good practices. HNP initiated a series of corrective actions to correct the weaknesses and to address the item for management attention. The staff concluded from this self-assessment and the corrective actions that the Lubricating Oil Analysis Program was effective but strengthened by the industry input.

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.

<u>FSAR Supplement</u>. In LRA Section A.1.1.25, the applicant provided the FSAR supplement for the Lubricating Oil Analysis Program. The staff reviewed this section and determines that the information in the FSAR supplement, with Commitment No. 21, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. 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. Also, the staff reviewed the enhancement and confirmed that their implementation (Commitment No. 21) 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 FSAR 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 ASME Section XI, Subsection IWE Program

Summary of Technical Information in the Application. LRA Section B.2.26 describes the existing ASME Section XI, Subsection IWE Program as consistent, with exception and enhancements, with GALL AMP XI.S1, "ASME Section XI, Subsection IWE."

The ASME Section XI, Subsection IWE Program periodically inspects Class MC components of the containment structure. The program is in accordance with the ASME Code, Section XI, Subsection IWE, 1992 Edition, with the 1992 Addenda, as modified by 10CFR50.55a. The ASME Section XI, Subsection IWE Program is credited for the aging management of:

- the metallic liner (including attachments) for the concrete containment
- the penetration sleeves including the personnel airlock, emergency airlock, and equipment hatch
- pressure-retaining bolted connections within the boundary of the concrete containment vessel
- seals, gaskets, and moisture barriers.

The primary inspection method for the ASME Section XI, Subsection IWE Program is periodic visual examination along with limited volumetric examinations utilizing ultrasonic thickness measurements as needed.

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 and enhancements to determine whether the AMP, with the exception and enhancements, remained adequate to manage the aging effects for which the LRA credits it.

Exception. The LRA states an exception to the GALL Report program element "scope of the program, specifically:

> GALL AMP XI.S1 describes the ASME Section XI Subsection IWE Program as conforming to the requirements of ASME Section XI Subsection IWE, 2001 Edition including the 2002 and 2003 Addenda. The current HNP ASME Section XI, Subsection IWE program plan for the first ten-year inspection interval defined from September 9, 1998 to September 8, 2008, approved per 10 CFR 50.55a, is based on ASME Section XI Subsection IWE, 1992 Edition with 1992 Addenda. The difference between the HNP Code of record and the Code edition specified in the GALL Report is considered to be an exception to the GALL Report criteria.

During the audit and review, the staff noted that in the license renewal basis calculation the following statement of the exception to the AMP "scope of the program" program element:

> In conformance with 10 CFR 50.55a(g)(4)(ii), the ISI Program is updated during each successive 120-month inspection interval to comply with the requirements of the latest

edition and addenda of the Code specified 12 months before the start of the inspection interval.

LRA page B-76 describing the exception to the "scope of the program element" for the ASME Section XI, Subsection IWE Program omits this statement. The staff asked the applicant to explain this omission from the LRA.

By letter dated August 20, 2007, the applicant stated that by oversight it inadvertently had not repeated in the LRA the 10 CFR 50.55a requirement to update the ISI program during each successive 120-month inspection interval to comply with the latest code edition and addenda 12 months before the start of the next inspection interval, This update required by NRC regulation applies to the ASME Section XI, Subsection IWE Program. On the basis of this response, an LRA amendment will incorporate this requirement.

In the same August 20, 2007, letter, the applicant proposed to amend the LRA Section B.2.26 "scope of the program" program element to add the 10 CFR 50.55a requirement statement.

The staff found the applicant's response acceptable because it explained that the license renewal basis calculation statement was left out of the LRA by oversight.

GALL AMP XI.S1, "ASME Section XI, Subsection IWE," specifies the ASME Section XI Subsection IWE, 2001 Edition including 2002 and 2003 Addenda as the code edition with which license renewal applicants must comply to be consistent with the GALL Report. The ASME Section XI, Subsection IWE Program complies with the ASME Section XI Subsection IWE, 1992 Edition with 1992 Addenda. Although there are differences between code editions, the program complies with a Section XI edition approved per 10 CFR 50.55a for use at the time of implementation. Implementation to this earlier code edition meets the intent of the GALL Report.

The staff found the exception acceptable because the edition of record is an ASME Code version earlier than that specified by the GALL Report. The use of the 1992 Edition with 1992 Addenda was acceptable per 10 CFR 50.55a at the time of its implementation. As stated in the applicant's response to the staff's question, the ISI program during each successive 120-month inspection interval will be updated to comply with the latest code edition and addenda specified per 10 CFR 50.55a 12 months before the start of the inspection interval. When HNP enters the period of extended operation, the ASME Code edition specified in 10 CFR 50.55a will be different from the ASME Section XI Subsection IWE, 2001 Edition with 2002 and 2003 Addenda specified in the GALL Report.

<u>Enhancement 1</u>. The LRA states the following enhancements in meeting the GALL Report program elements "parameters monitored or inspected" and "acceptance criteria," specifically:

> Revise administrative controls to include discoloration, surface discontinuities and other signs of surface irregularities as recordable conditions for coated and uncoated surfaces.

During the audit and review, the staff noted that a specific procedure for ASME Section XI Subsection IWE general visual inspections implements the existing ASME Section XI, Subsection IWE Program; however, the procedure does not address discoloration, surface discontinuities, and other signs of surface irregularities as recordable conditions. A form in the procedure used by NDE examiners does include these aging effects as adverse conditions to be detected; however, the applicant will revise the procedure to include them as recordable conditions.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 22, item No. 1) to enhance program implementing procedures to include additional recordable conditions. The staff finds this commitment acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the “parameters monitored or inspected” and “acceptance criteria” program elements.

Enhancement 2. The LRA states the following enhancements in meeting the GALL Report program elements "parameters monitored or inspected" and "acceptance criteria," specifically:

> Revise administrative controls to include moisture barriers and parameters identified by Table IWE-2500-1 for Category E-D for aging effects of wear, damage, erosion, tear, surface cracks, or other defects that may violate the leak-tight integrity.

The staff also noted that the same plant-specific procedure for ASME Section XI Subsection IWE general visual inspections does not address seals, gaskets, and moisture barriers and parameters specified by the GALL Report for Category E-D for aging effects wear, damage, erosion, tear, surface cracks, or other defects that may violate leak-tight integrity; however, another plant-specific procedure addressing IWE and IWL inspections implements the existing ASME Section XI, Subsection IWE Program. This procedure states in its appendices that visual examination per Category E-D is required. The applicant will revise the plant-specific procedure for ASME Section XI Subsection IWE general visual inspections to include moisture barriers and parameters shown by Table IWE-2500-1 for Category E-D for aging effects of wear, damage, erosion, tear, surface cracks, or other defects that may violate leak-tight integrity.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 22, item No. 2) to enhance program implementing procedures to include moisture barriers and their aging effects. The staff finds this commitment acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the “parameters monitored or inspected” and “acceptance criteria” program elements.

Enhancement 3. The LRA states the following enhancements in meeting the GALL Report program elements "parameters monitored or inspected" and "acceptance criteria," specifically:

> Revise administrative controls to include pressure retaining bolting parameters identified by Table IWE-2500-1 for Category E-G for visual inspection and bolt torque or tension test.

The staff noted also that the plant-specific procedure for ASME Section XI Subsection IWE general visual inspections does not address pressure-retaining bolting and parameters specified by the GALL Report for Category E-G for visual inspection and bolt torque or tension tests. Another plant-specific procedure addressing IWE and IWL inspections states in its appendices that visual examination per Category E-G is required. The applicant will revise the plant-specific procedure for ASME Section XI Subsection IWE general visual inspections to include pressure-retaining bolting parameters shown in Table IWE-2500-1 for Category E-G for visual inspection and bolt torque or tension tests or ASME Code Case N-604.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 22, item No. 3) to enhance program implementing procedures to include pressure-retaining bolting and their aging effects. The staff finds this commitment acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the "parameters monitored or inspected" and "acceptance criteria" program elements.

Enhancement 4. The LRA states the following enhancements in meeting the GALL Report program elements "parameters monitored or inspected" and "acceptance criteria," specifically:

> Revise administrative controls to discuss augmented examinations per IWE-1240 and inspections identified by Table IWE-2500-1 for Category E-C.

The staff noted also that the plant-specific procedure for ASME Section XI Subsection IWE general visual inspections does not address Examination Category E-C, Containment Surfaces Requiring Augmented Examination; however, another plant-specific procedure addressing IWE and IWL inspections and visual and volumetric examination methods for minimum wall thickness includes augmented inspection evaluations. the applicant will revise the plant-specific procedure for ASME Section XI Subsection IWE general visual inspections to include augmented examinations per IWE-1240 and inspections shown in Table IWE-2500-1 for Category E-C.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 22, item No. 4) to enhance the program implementing procedures to include augmented examinations. The staff finds this commitment acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the "parameters monitored or inspected" and "acceptance criteria" program elements.

During the audit and review, the staff asked the applicant why the program enhancements need to address surface irregularities, moisture barriers, pressure-retaining bolting, and augmented examinations if the program has been in compliance with ASME Code Section XI, Subsection IWE since the NRC final rulemaking in 1996 to require IWE inspections and how the current IWE program addresses or inspects these four items.

By letter dated August 20, 2007, the applicant stated that the administrative engineering surveillance test procedure for ASME Code Section XI, Subsection IWE general visual examination does not address surface irregularities (for metallic surfaces without coatings), moisture barriers, pressure-retaining bolting, and augmented examinations specifically but that the first containment inspection interval program document and specific QA inspection documents include these items. The enhancement only improves the administrative procedure by including in one administrative procedure instructions for all IWE inspection requirements.

The program has complied with ASME Code Section XI, Subsection IWE since the NRC final rulemaking in 1996 to require IWE inspections. The first Subsection IWE containment inspection interval is from September 9, 1998, to September 8, 2008 as described in the HNP containment inspection program.

The program addresses the four items as follows:

Surface irregularities - The administrative engineering surveillance test procedure for the ASME Section XI, Subsection IWE Category E-A, containment surfaces inspections does not currently list surface irregularities as a specific recordable condition. However, gouges, dents, bulges, and other damage, deformation, or degradation are listed as recordable conditions in the HNP administrative engineering surveillance test procedure and envelopes surface irregularities. The enhancement adds the specific term of "surface irregularities" to the HNP administrative engineering surveillance test procedure. It should also be noted that a QA visual examination form is utilized for inspection of various MC surfaces and it does include "surface irregularities" as a specific recordable condition.

Moisture barriers - The inspections of the Category E-D, moisture barrier is performed using a QA visual examination form with the appropriate inspection attributes (wear, damage, erosion, tear, cracks, or other defects). The completed QA visual examination form for the moisture barrier inspections is attached to the administrative engineering surveillance test procedure for the ASME Section XI, Subsection IWE Program as a QA record.

Pressure retaining bolting - The inspections of the Category E-G, Pressure Retaining Bolting is performed using the first containment inspection interval containment inspection program document and a QA visual examination form.

Augmented examinations - An evaluation of the potential Category E-C, Containment Surfaces requiring augmented examination are included as an Appendix to the first containment inspection interval containment inspection program document. However no areas have been identified as surface areas requiring augmented examination.

The staff finds the applicant's response acceptable. The applicant has demonstrated that all the required and proper inspections have been in accordance with Subsection IWE and that the enhancement only improves an administrative procedure by including in it instructions for all Subsection IWE inspection requirements.

On this basis, the staff finds all enhancements acceptable because, when implemented, the ASME Section XI, Subsection IWE Program will be consistent with GALL AMP XI.S1 and will assure adequate management of the effects of aging.

During the audit and review, the staff noted that LRA Appendix B has no Protective Coating Monitoring and Maintenance Program section and asked the applicant to explain how HNP meets the intent of GL 98-04, Generic Safety Issue (GSI) 191, and GL 2004-02.

By letter dated August 20, 2007, the applicant stated that actions taken for GL 98-04, GSI 191, and GL 2004-02 are parts of the CLB and that some remain ongoing.

The NRC issued GL 98-04:

- to alert addressees that findings of foreign material inside operating nuclear power plant containments continue

- to alert addressees to problems with the material condition of Service Level 1 protective coatings inside the containment

- to request information to evaluate addressee programs to ensure that Service Level 1 protective coatings inside containment do not detach from their substrate during a design-basis loss-of-coolant accident and interfere with emergency core cooling system and safety-related containment spray system operations.

The applicant's November 9, 1998, response to GL 98-04 provided the requested information and the NRC closed out this issue by correspondence dated November 16, 1999.

As stated in GL 2004-024, BWR research findings indicated that fibrous material plus particulate material could result in a head loss substantially greater than that which an equivalent amount of either type of debris could alone. These research findings prompted the NRC to open GSI-191, "Assessment of Debris Accumulation on PWR Sump Performance." The objective of GSI-191 is that post-accident debris blockage not impede or prevent the operation of the emergency core cooling system and containment spray system in recirculation mode at PWRs during loss-of-coolant or other high-energy line break accidents for which sump recirculation is required.

In resolution of these issues, GL 2004-02 requested from addressees the following actions:

- By an NRC-approved methodology, a mechanistic evaluation of potential adverse effects of post-accident debris blockage

- Plant modifications indicated by the mechanistic evaluation as necessary for system functionality

GL 2004-02 requested from addressees the following information within 90 days of the safety evaluation report with guidance for the requested evaluation:

- Planned actions and a schedule for completion of the requested evaluation of adverse effects of post-accident debris blockage

- A statement of intent to include a containment walkdown surveillance in support of the evaluation of susceptibility to the adverse effects of post-accident debris blockage

The applicant provided this information by correspondence dated March 4, 2005.

GL 2004-02 further requested from addressees the following information by September 1, 2005:

- Confirmation that the emergency core cooling system and containment spray system recirculation functions under debris loading conditions are or will be in compliance with regulatory requirements listed in GL 2004-02

- A general description of and implementation schedule for all corrective actions, including any plant modifications

- A description of the methodology for the evaluation for the adverse effects of post-accident debris blockage

- A general description of and planned schedule for any changes to plant licensing bases resulting from any evaluation or plant modification

- A description of existing or planned programmatic controls to assess potential sources of debris introduced into containment for adverse effects of post-accident debris blockage.

The applicant provided this information by correspondence dated September 1, 2005; furthermore, the September 1, 2005, letter makes the following commitment:

> Complete the corrective actions of this response letter (HNP-05-101) to Generic Letter (GL) 2004-02 by the GL requested due date of December 31, 2007.

As noted, activities under GL 98-04, GSI 191, and GL 2004-02 are parts of the CLB. The applicant committed to completion by December 31, 2007, of corrective actions described in correspondence dated September 1, 2005.

The staff finds the applicant's response acceptable. The NRC accepted HNP's response to GL 98-04 in a letter dated November 16, 1999. The NRC found that HNP maintained an effective qualified coatings program in the containment. GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program," states:

> A comparable program for monitoring and maintaining protective coatings inside containment, developed in accordance with RG 1.54, Rev. 0 or the American National Standards Institute (ANSI) standards (since withdrawn) referenced in RG 1.54, Rev. 0, and coatings maintenance programs described in license responses to GL 98-04, is also acceptable as an AMP for license renewal.

The staff reviewed the HNP response to GL 98-04 that its qualified coatings program in the containment is subject to RG 1.54 and ANSI standards and determined that the coatings maintenance program described in the response 98-04 is acceptable as an AMP for license renewal with no additional AMP required for consistency with the GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program."

Operating Experience. LRA Section B.2.26 states that the ASME Section XI, Subsection IWE Program is implemented and maintained in accordance with general requirements for engineering programs for assurance that the program effectively meets regulatory and procedural requirements, including periodic reviews. Qualified personnel assigned as program managers have authority and responsibility to implement the program and to commit adequate resources to program activities.

Plant-specific operating experience shows numerous assessments, both plant-specific and corporate, of program development, effectiveness, and implementation. The ASME Section XI, Subsection IWE Program is upgraded continually based upon industry and plant-specific experience. Additionally, plant-specific operating experiences are exchanged among CP&L sites through regular peer group meetings, a common corporate sponsor, and outage participation of site program managers.

During the audit and review, the staff noted that LRA Section B.2.26 lists no actual containment Subsection IWE ISI findings under operating experience. The staff asked the applicant to document from discovery to resolution any historical containment IWE ISI findings.

By letter dated August 20, 2007, the applicant stated it had documented a detailed operating experience review in the license renewal basis calculation for the ASME Section XI, Subsection IWE Program available for review at HNP as are specific examination reports. The following summarizes the findings.

The containment inspection program document for the first containment inspection interval presents an historical record of containment inspections prior to implementation of the ASME Section XI, Subsection IWE Program:

HNP detected vertical liner corrosion between the base slab and liner in RFO-7 (1997). HNP engineering determined that the liner thickness met design requirements and that moisture barrier deterioration was the root cause. HNP removed the entire moisture barrier during RFO-8 (1998), cleaned the liner, confirmed the thickness to meet design requirements, coated it, and installed a high-density silicone seal moisture barrier. HNP examined the vertical and horizontal liner at the base slab during RFO-8 and RFO-9 and found only minor corrosion with no further actions required. Examination of the liner plate below the top of the base slab in RFO-7 after removal of the moisture barrier found only minor corrosion. Examination of a sample section of liner under the sump topping slab also found no corrosion. There was corrosion of the exterior surface of the "A" containment spray valve chamber due to persistent groundwater intrusion found in 1993 but only minor corrosion recorded and UT followed.

Docketed Letter HNP-00-122, "Inservice Inspection Summary Report, to the USNRC from James Scarola," dated October 18, 2000, documents Subsection IWE inspections in RFO-9 (completed 05/12/00). The responsible engineer and the program manager observed some recordable indications (coating blisters, mechanical damage to coatings, and discolored coatings on the liner) but determined them to be irrelevant. There was no significant metal loss in the areas but some rust and pitting inside the "A" containment spray valve chamber. The metal thickness, however, was above nominal thickness as determined by UT. The liner under the transfer canal was bulged but found acceptable by HNP engineering with no further action needed. Examination of the containment liner and penetrations, moisture barrier, penetrations gaskets, and penetration bolting was complete.

Docketed Letter HNP-05-018, "Inservice Inspection Summary Report to USNRC from DH Corlett," dated February 15, 2005, documents Subsection IWE inspections in RFO-12 (completed 11/15/04). There were no recordable conditions on the containment liner from the moisture barrier to the center of the dome, a number of nonrecordable conditions (scattered mechanical damage, blisters with no resulting material loss, and small areas with flaking coatings) on the containment liner, and a recordable indication (blistering) on the protective coating inside the lower regions of each of the valve chambers. UT found no significant material reduction and the surfaces were recoated. Examination of the containment liner and penetrations, moisture barrier, valve chamber internals and bolting, equipment hatch, the refueling access sleeve was complete.

Docketed Letter HNP-06-081, "90 day Inservice Inspection (ISI) Summary Report To USNRC from DH Corlett," dated August 10, 2006, documents Subsection IWE inspections in RFO-13 (completed 05/16/06). The report states that no examinations of ASME Class MC components were required or scheduled but, as prudent measures, examinations of the moisture barrier and approximately 12" up from the moisture barrier on the liner observed no recordable indications. The report also states a visual inspection inside the "A" containment spray valve chamber including the bolts and nuts on the manway observed no recordable conditions. In addition to the report, a visual examination inside the three remaining valve chambers observed no recordable conditions. HNP repaired One small damaged coating area in the "A" containment spray valve chamber.

The staff finds the applicant's response acceptable. Plant-specific operating experience shows that the ASME Section XI, Subsection IWE Program has been effective in managing aging of components for which the LRA credits it.

During the audit and review, the staff reviewed the operating experience documented in the license renewal basis calculation for the ASME Section XI, Subsection IWE Program and a 2005 HNP corporate Nuclear Assessment Section assessment of the ISI programs. The assessment stated that the ISI programs effectively fulfill their requirements but reported three weaknesses and one management concern. Two weaknesses were in the IWE program. The first was that the ISI pressure test and repair replacement program documentation and backlog did not support some program requirements. HNP revised a procedure and completed documentation to address this weakness. The second program weakness was that some engineering program reviews and program health reports were not consistent with program requirements and site standards. HNP completed corrective actions and communicated engineering programs expectations to program managers and backups.

During the audit and review, the staff review of the additional operating experience documented in the license renewal basis calculation for the ASME Section XI, Subsection IWE Program revealed no unusual or significant findings.

On the basis of its review of plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's ASME Section XI, Subsection IWE Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.26, the applicant provided the FSAR supplement for the ASME Section XI, Subsection IWE Program. By letter dated August 20, 2007, the applicant proposed Commitment No. 22 to enhance the ASME Section XI, Subsection IWE Program prior to the period of extended operation. The staff reviewed this section and determines that, with Commitment No. 22, the information in the FSAR 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 ASME Section XI, Subsection IWE 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 their justifications 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 their implementation through Commitment No. 22, 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 FSAR 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 ASME Section XI, Subsection IWL Program

Summary of Technical Information in the Application. LRA Section B.2.27 describes the existing ASME Section XI, Subsection IWL Program as consistent, with exception, with GALL AMP XI.S2, "ASME Section XI, Subsection IWL."

The ASME Section XI, Subsection IWL Program periodically visually inspects reinforced concrete containment structures in accordance with ASME Code, Section XI, Subsection IWL, 1992 Edition, 1992 Addenda, and is credited for the aging management of accessible and inaccessible pressure-retaining primary containment concrete. HNP concrete containments do not utilize a post-tensioning system; therefore, the IWL requirements for a post-tensioning system do not apply.

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 the LRA credits it.

The staff interviewed the applicant's technical personnel and reviewed the applicant's the ASME Section XI, Subsection IWL Program license renewal basis calculation, in which the applicant assessed program consistency with GALL AMP XI.S2, "ASME Section XI, Subsection IWL," as well as program ISI procedures and 10-year ISI plans. Specifically, the staff reviewed the program elements (documented in SER Section 3.0.2.1) for the ASME Section XI, Subsection IWL Program and their basis documents, as listed in the Audit Report, for consistency with GALL AMP XI.S2. Based on its review of these documents, the staff determined that the program elements of the ASME Section XI, Subsection IWL Program are consistent with the recommended criteria in the program elements of GALL AMP XI.S2, "ASME Section XI, Subsection IWL," with the following exception.

Exception. The LRA states the following exception to the GALL Report program element "scope of the program:"

> GALL AMP XI.S2 describes the ASME Section XI Subsection IWL Program as conforming to the requirements of ASME Section XI Subsection IWL, 1992 edition with the 2001 Edition including the 2002 and 2003 Addenda. The current HNP ASME Section XI, Subsection IWL Program plan for the First Ten-Year inspection interval defined from September 9, 1998 to September 8, 2008, approved per 10 CFR 50.55a, is based on ASME Section XI, Subsection IWL, 1992 Edition, with 1992 Addenda. The difference between the HNP Code of record and Code edition specified in the GALL Report is considered to be an exception to the GALL Report criteria.

The GALL AMP XI.S2, "ASME Section XI, Subsection IWL," program description recommends ASME Code Section XI, Subsection IWL editions acceptable for aging management of concrete containment structures:

> This evaluation covers both the 1992 Edition with the 2001 Edition including the 2002 and 2003 Addenda, as approved in 10 CFR 50.55a. ASME Code Section XI, Subsection IWL and the additional requirements specified in 10 CFR 50.55a(b)(2) constitute an existing mandated program applicable to managing aging of containment reinforced concrete and unbonded post-tensioning systems for license renewal.

During the audit, the staff asked the applicant for its basis for the exception to the program description. The applicant stated that in accordance with 10 CFR 50.55a(g)(4)(ii), it updates the ISI program during each successive 120-month inspection interval to comply with the requirements of the latest code edition and addenda specified 12 months before the start of the inspection interval. The applicant pointed out that Section 7.3.1 of the program basis document, annotate this statement inadvertently omitted from the LRA description of the exception to the "scope of the program" program element of the ASME Section XI, Subsection IWL Program. The applicant stated that it would amend LRA Section B.2.20 to incorporate the statement.

The staff verified the applicant's LRA amendment to incorporate this statement by letter dated August 20, 2007.

At present, an ASME Section XI ISI (Subsection IWL) program is approved for use on an ASME Code 10-year ISI interval basis. The applicant has indicated, in its exception, that it is in its first 10-Year ISI interval for concrete containment structures and that the edition of record for this interval is the ASME Code Section XI, Subsection IWL, 1992 edition with 1992 Addenda. The statement in the program description of GALL AMP XI.S2, "ASME Section XI, Subsection IWL," means that acceptable editions ASME Code Section XI, Subsection IWL to date include the 1992 through 2001 code editions with 2002 and 2003 Addenda; thus, the staff concludes that the edition for the exception is consistent with the allowable editions of the ASME Code Section XI, Subsection IWL in the GALL AMP XI.S2 program description and thus not an actual exception. On this basis, the staff finds the exception acceptable.

The staff also reviewed portions of the ASME Section XI, Subsection IWL Program for which the applicant claimed consistency with GALL AMP XI.S2 and found them consistent. Based on this finding, the staff concludes that the "scope of program" and other program elements of the applicant's ASME Section XI, Subsection IWL Program are consistent with the program description and program elements of GALL AMP XI.S2, and acceptable.

Based on its review, the staff finds the applicant's ASME Section XI, Subsection IWL Program, with the exception, acceptable assurance of adequate management of the effects of aging.

Operating Experience. LRA Section B.2.27 states that the ASME Section XI, Subsection IWL Program is implemented and maintained in accordance with general requirements for engineering programs for assurance that the program effectively meets regulatory and procedural requirements, including periodic reviews. Qualified personnel assigned as program managers have authority and responsibility to implement the program and to commit adequate resources to its activities.

Plant-specific operating experience shows numerous assessments, both plant-specific and corporate, of program development, effectiveness, and implementation. The ASME Section XI, Subsection IWL Program is upgraded continually based upon industry and plant-specific operating experience. Additionally, plant-specific operating experiences are exchanged among CP&L sites through regular peer group meetings, a common corporate sponsor, and outage participation of site program managers.

The staff reviewed the operating experience element in the license renewal basis calculation and plant-specific assessments and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry operating experience. In addition, the applicant stated that it upgrades the ASME Section XI, Subsection IWL Program continually based upon industry and plant-specific operating experience.

After the review of plant-specific assessments and discussions with the applicant's technical personnel, the staff concludes with reasonable assurance that the applicant's ASME Section XI, Subsection IWL Program will manage adequately the aging effects and aging effect mechanisms for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.27, the applicant provided the FSAR supplement for the ASME Section XI, Subsection IWL Program. The staff reviewed this section and determines that the information in the FSAR 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 ASME Section XI, Subsection IWL 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 their justifications 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 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.21 ASME Section XI, Subsection IWF Program

Summary of Technical Information in the Application. LRA Section B.2.28 describes the existing ASME Section XI, Subsection IWF Program as consistent, with exceptions, with GALL AMP XI.S3, "ASME Section XI, Subsection IWF."

The ASME Section XI, Subsection IWF Program visually examines component and piping supports within the scope of license renewal for loss of material and loss of mechanical function. The program is implemented through plant procedures for visual examination of ISI Classes 1, 2, and 3 supports. Visual examination is in accordance with the requirements of ASME Section XI, Subsection IWF, 1989 Edition with no Addenda and ASME Code Case N-491-2 for component supports other than snubbers. For the snubber attachments and their fasteners, inspections are in accordance with technical specifications. The applicable code for the snubber attachments and fasteners is the ASME Operation and Maintenance (OM) Code, 1995 Edition with 1996 Addenda, and ASME OM Code Case OMN-13.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions to determine whether the

AMP, with the exceptions, remained adequate to manage the aging effects for which the LRA credits it.

The staff interviewed the applicant's technical personnel and reviewed the applicant's basis documents related to the ASME Section XI, Subsection IWF Program in which the applicant assessed its program consistency with GALL AMP XI.S3, "ASME Section XI, Subsection IWF."

The staff reviewed the ASME Section XI, Subsection IWF Program basis documents, including the license renewal basis calculation, which assesses consistency of the program elements with those recommended in GALL AMP XI.S3. Specifically, the staff compared the program element descriptions (documented in SER Section 3.0.2.1) in the license renewal basis calculation to the program element criteria recommended in GALL AMP XI.S3, "ASME Section XI, Subsection IWF," and basis documents, as listed in the Audit Report, for consistency with the program elements recommended in GALL AMP XI.S3.

Based on its review of the ASME Section XI, Subsection IWF Program license renewal basis calculation and supporting basis documents, the staff determined the AMP program elements incorporate the recommended criteria from program elements defined in GALL AMP XI.S3, "ASME Section XI, Subsection IWF," with the following exception evaluated in this section. Based on this evaluation, the staff finds the program elements for the ASME Section XI, Subsection IWF Program consistent with the recommended program elements in GALL AMP XI.S3 and acceptable assurance of adequate management of aging effects for the component and pipe supports during the period of extended operation with the following exception evaluated in the following paragraphs:

Exception. The LRA states an exception to the "scope of program" and "parameters monitored/inspected" program elements of GALL AMP XI.S3, "ASME Section XI, Subsection IWF," specifically:

> NUREG-1801, Section XI.S3, describes the ASME Section XI Subsection IWF Program as conforming to the requirements of ASME Section XI Subsection IWF, 2001 edition including the 2002 and 2003 Addenda. The current HNP ASME Section XI, Subsection IWF program plan for the second ten-year interval defined from February 2, 1998 through May 1, 2007, approved per 10 CFR50.55a, for components and supports is based on ASME Section XI Subsection IWF, 1989 Edition (no Addenda). Snubber attachments and fasteners are based on the 1995 Edition with 1996 Addenda of the ASME OM Code and ASME OM Code Case OMN-13. In conformance with 10 CFR 50.55a(g)(4)(ii), the ISI Program is updated during each successive 120-month inspection interval to comply with the requirements of the latest edition and addenda of the Code specified twelve months before the start of the inspection interval. The difference between the HNP Code of record and the Code edition specified in NUREG-1801 is considered to be an exception to NUREG-1801 criteria.

During the audit, the staff asked the applicant for the schedule for updating the ASME Section XI, Subsection IWF Program to a later ASME Code edition for the period of extended operation.

In response to the staff's question the applicant replied that in accordance with 10 CFR 50.55a(g)(4)(ii), ISI program updates during each successive 120-month inspection interval comply with the requirements of the latest code edition and addenda specified 12 months before the start of the inspection interval.

The 10 CFR 50.55a requirements govern application and implementation of codes and standards, including the ASME Code Section XI. Paragraph (g)(4)(ii) of 10CFR50.55a requires updating of the ASME Code Section XI edition of record for an applicant's ISI program to the most recent edition of the code endorsed in rule at least twelve months prior to the next successive 10-year (*i.e.*,120-month) ISI interval.

The staff noted that at the time of the LRA submission the applicant was in its second 10-Year ISI interval and that the ASME Code Section XI edition of record for that interval was the 1989 Edition with no addenda. The staff also reviewed the license renewal basis calculation and noted that HNP entered its third 10-Year ISI interval on May 2, 2007, and that the ASME Code Section XI code of record for that interval is the 2001 Edition with 2003 Addenda. This edition is consistent with that specified in GALL AMP XI.M1.

The applicant must update its ASME Code Section XI edition of record to the 2001 Edition with 2003 Addenda, and as this edition is the same as that recommended in GALL AMP XI.S3, "ASME Section XI, Subsection IWF," the staff concludes that the exception to GALL AMP XI.M1 is no longer part of the review of this AMP, instead, that the program elements of the applicant's ASME Section XI, Subsection IWF Program are consistent with those of GALL AMP XI.M3. Reactor Head Closure Studs," and acceptable.

During the audit, the staff asked the applicant to justify exclusion of the ASME Class MC supports from this program.

The applicant stated that there are no ASME Class MC supports at HNP, as indicated in the First Containment Inspection Interval Containment Inspection Program section, stating, "The welded attachments to the metallic liner (e.g., floor beams, seismic restraints, leak channels, equipment/pipe supports, etc.) do not perform a pressure retaining function associated with the containment support load path." For this reason, the applicant clarified that the welded attachments are nonstructural components not subject to inspection.

The staff found applicant's response acceptable and verified that FSAR Section 3.2, "Classification of Structures, Components, and Systems," indicates no MC supports.

The staff asked the applicant to justify use of ASME Code and ASME OM Code Case OMN-13 for snubber attachments and their fasteners.

The applicant stated that the snubbers are not within the scope of license renewal; therefore, it would remove references to ASME OM Code and ASME Code Case OMN-13 from LRA Sections B.2.28 and A.1.1.2.8 in an amendment to the application. The applicant clarified that inspection of component and piping supports will continue in accordance with ASME Code Section XI, Subsection IWF.

The staff found applicant's response acceptable and verified that the snubbers were not within the scope of license renewal per LRA Section 2.1.2. Inspection of all component and pipe supports by the applicant per ASME Section XI Subsection IWF is acceptable. The staff verified that the applicant made the LRA amendment in a letter dated August 31, 2007.

Based on its review, the staff finds the applicant's ASME Section XI, Subsection IWF Program consistent with the program elements of GALL AMP XI.S3, "ASME Section XI, Subsection IWF," and acceptable for implementation. Based on this finding, the staff concludes that the ASME Section XI, Subsection IWF Program assures adequate management of the effects of aging.

Operating Experience. LRA Section B.2.28 states that the ASME Section XI, Subsection IWF Program is implemented and maintained in accordance with general requirements for engineering programs for assurance that the program effectively to meets regulatory and procedural requirements, including periodic reviews. Qualified personnel assigned as program managers have authority and responsibility to implement the program and to commit adequate resources to program activities.

Plant-specific operating experience shows numerous assessments, both plant-specific and corporate, of program development, effectiveness, and implementation. The ASME Section XI, Subsection IWF Program is upgraded continually based upon industry and plant-specific operating experience. Additionally, plant-specific operating experiences are exchanged among CP&L sites through regular peer group meetings, a common corporate sponsor, and outage participation of site program managers.

The LRA states that ASME Section XI, Subsection IWF Program implementation and maintenance are in accordance with general requirements for engineering programs for assurance that the program is effectively meets regulatory, process, and procedure requirements, including periodic reviews; qualified personnel assigned as program managers have authority and responsibility to implement the program with and adequate resources committed to its activities.

Plant-specific operating experience shows numerous assessments, both a plant-specific and corporate, dealing with program development, effectiveness, and implementation. The applicant upgrades the IWF program continually based upon industry and plant-specific operating experience. Additionally, the applicant sites share plant-specific operating experiences through regular peer group meetings, a common corporate sponsor, and outage participation of site program managers.

After review of plant-specific assessments and discussions with the applicant's technical personnel, the staff concludes with reasonable assurance that the ASME Section XI, Subsection IWF Program will manage adequately the aging effects and aging effect mechanisms for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.28, the applicant provided the FSAR supplement for the ASME Section XI, Subsection IWF Program. The staff reviewed this section and determines that the information in the FSAR 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 ASME Section XI, Subsection IWF 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 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.22 10 CFR Part 50, Appendix J Program

Summary of Technical Information in the Application. LRA Section B.2.29 describes the existing 10 CFR Part 50, Appendix J Program as consistent, with enhancement, with GALL AMP XI.S4, "10 CFR 50, Appendix J."

The 10 CFR Part 50, Appendix J Program monitors leakage rates through containment liner/welds, penetrations, fittings, and access openings to detect degradation of the pressure boundary.

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, remained adequate to manage the aging effects for which the LRA credits it. An evaluation and appropriate corrective actions address leakage rates exceeding acceptance criteria. For integrated leak rate testing, the program is in accordance with 10 CFR Part 50, Appendix J, Option B (performance-based leak testing), with the guidelines of RG 1.163 (September 1995), and with NEI 94-01, "Industry Guideline for Implementing Performance Based Option of 10 CFR Part 50, Appendix J." For local leak rate testing, the program is in accordance with the prescriptive requirements of 10 CFR Part 50, Appendix J, Option A for Type B and Type C tests.

Enhancement. The LRA states the following enhancement to the GALL Report program element "corrective actions," specifically:

Administrative controls that implement the program will be revised to describe the evaluation and corrective actions to be taken when leakage rates do not meet their specified acceptance criteria.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 23) to enhance program implementing procedures to require evaluation and corrective actions when leakage rates do not meet specified acceptance criteria. The staff finds this commitment acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the "corrective actions" program element.

Operating Experience. LRA Section B.2.29 states that the 10 CFR Part 50, Appendix J Program is maintained in accordance with general requirements for engineering programs for assurance that the program effectively meets regulatory and procedural requirements, including periodic reviews. Qualified personnel assigned as program managers have authority and responsibility to implement the program and to commit adequate resources to its activities.

During the audit and review, the staff reviewed various nuclear condition reports of measured leakage rates outside acceptance criteria and the corrective actions taken. These reports maintained by the10 CFR Part 50, Appendix J Program engineer were available at HNP. The staff noted no instances of 10 CFR Part 50, Appendix J, test failures due to causes other than valve or flange seat leakage. HNP evaluated and corrected all such failures.

On the basis of its review of plant-specific operating experience and discussions with the applicant's technical personnel, the staff finds that the applicant's 10 CFR Part 50, Appendix J Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.29, the applicant provided the FSAR supplement for the 10 CFR Part 50, Appendix J Program. By letter dated August 20, 2007, the applicant proposed Commitment No. 23 to enhance the 10 CFR Part 50, Appendix J Program prior to the period of extended operation. The staff reviewed this section and determines that, with Commitment No. 23, the information in the FSAR 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 10 CFR Part 50, Appendix J Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that their implementation through Commitment No. 23 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.23 Masonry Wall Program

Summary of Technical Information in the Application. LRA Section B.2.30 describes the existing Masonry Wall Program as consistent, with enhancement, with GALL AMP XI.S5, "Masonry Wall Program."

The Masonry Wall Program manages aging effects to keep the evaluation basis for each masonry wall within the scope of license renewal valid through the period of extended operation. The program includes masonry walls with intended functions in accordance with 10 CFR 54.4. Included are the masonry walls within the containment building, reactor auxiliary building, diesel generator building, fuel handling building, heating, ventilating, and air-conditioning (HVAC) equipment room, security building, tank area/building, turbine building, and the waste processing building. The program monitors conditions with inspection frequencies established for 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, remained adequate to manage the aging effects for which the LRA credits it.

Enhancement. The LRA states the following enhancement to the GALL Report program element "scope of the program," specifically:

> Revise program administrative controls to identify the structures that have masonry walls within the scope of license renewal.

During the audit and review, the staff noted that implementation of the existing Masonry Wall Program is through a maintenance rule structures monitoring procedure. The program includes all masonry walls performing intended functions in accordance with 10 CFR 54.4. Included are masonry walls within the Containment Building, Reactor Auxiliary Building (including the Common Building), Diesel Generator Building, Fuel Handling Building, HVAC Equipment Room, Security Building, Tank Area/Building (including Units 1 and 2), Turbine Building, and Waste Processing Building.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 24) to enhance this procedure to indicate structures with masonry walls within the scope of license renewal. The staff finds this commitment acceptable as the enhanced procedure will address GALL Report recommendations and be consistent with the "scope of the program" program element.

On this basis, the staff finds this enhancement acceptable because, when implemented, the Masonry Wall Program will be consistent with GALL AMP XI.S5 and will assure adequate management of the effects of aging.

During the audit and review, the staff noted that GALL AMP XI.S5, "Masonry Wall Program," under the "detection of aging effects" program element, states:

> The frequency of inspection is selected to ensure there is no loss of intended function between inspections. The inspection frequency may vary from wall to wall, depending on the significance of cracking in the evaluation basis. Unreinforced masonry walls, which have not been contained by bracing warrant the most frequent inspection, because the development of cracks may invalidate the existing evaluation basis.

The staff asked the applicant whether the inspection frequency varies from wall to wall at HNP.

In its response dated August 20, 2007, the applicant stated that the inspection interval established in a corporate-level inspection procedure for HNP and other fleet nuclear plants for masonry wall cracking varies from structure to structure but does not exceed ten years. Various frequencies based on safety significance (probabilistic safety analysis rating) of SSCs, the condition of the wall in previous structural inspection results, and accommodations to work load management for engineering personnel ensure no loss of intended function between inspections as described in GALL AMP XI.S5. For example, examinations of the masonry walls in the reactor containment building are at five-year intervals, the fuel handling building at seven-year intervals, the Turbine Building at eight-year intervals, and several nonsafety-related structures at nine-year intervals. Typically there is no established no inspection frequency from wall to wall within a structure; however the responsible engineer may establish an inspection frequency based on previous inspections. Since 1996, when the inspections began, they have found no unacceptable conditions from cracking; therefore, there has been no need to change the inspection interval for masonry walls. Unacceptable conditions in the future will require a nuclear condition report and corrective actions that could change the inspection interval for a masonry wall by the responsible engineer's disposition. The corporate procedure is the same for inspections of building concrete/grout. A recent example changed the inspection interval for a diesel generator foundation to yearly based on the condition of the grout. Also noteworthy is that there are no unreinforced masonry walls in safety-related areas.

HNP does not consider the methodology for selection of the inspection interval for masonry walls an exception to GALL AMP XI.S5 Program Attribute 4 because Bulletin 80-11 was issued to HNP for information while HNP was under construction. HNP designed and constructed Category I masonry walls as described in FSAR Section 3.8.4.8. To preclude problems addressed by Bulletin 80-11, HNP designed all-masonry walls in the proximity of safety-related equipment to meet seismic design criteria. QA/QC inspections of the walls were in accordance with implementation procedures. In addition, approval of equipment attachments to masonry block walls was case by case. HNP analyzes safety-related masonry walls in a structural calculation. Several NRC construction assessment teams that examined construction of the masonry walls in 1984 and 1986 reported Bulletin 80-11 requirements met. The following NRC letters document HNP design and construction of masonry walls to Bulletin 80-11 requirements: NRC Inspection Reports 50-400/84-41, 50-400/84-48, 50-400/86-03, 50-400/86-06, and 50-400/87/32. In conclusion, the HNP masonry wall construction was to Bulletin 80-11 requirements without the design and construction problems typical of earlier plants. The masonry walls have proven to be designed, constructed, and verified to QA requirements with no unacceptable conditions over 20 years after installation. HNP considers the responsible engineer's methodology in selecting the inspection intervals for masonry walls as meeting GALL AMP XI.S5 Program Attribute 4 attributes. In conclusion, there is no need to inspect nonreinforced masonry walls more frequently than reinforced masonry walls unless unacceptable conditions are present.

The staff finds the applicant's response acceptable. Plant-specific operating experience revealed no history of masonry wall aging effects. With this history the corrective action program adequately determines whether inspections of masonry walls beyond the program's current building inspection cycles should be more frequent.

Operating Experience. LRA Section B.2.30 states that the Masonry Wall Program is implemented through a corporate procedure with systematic measures to ensure the program objective of managing aging effects to keep the evaluation basis for each masonry wall within the scope of license renewal valid through the period of extended operation. The Masonry Wall Program is included within the scope of the Maintenance Rule Program implemented and maintained in accordance with general requirements for engineering programs for assurance that the Masonry Wall Program effectively meets regulatory and procedural requirements, including periodic reviews. Qualified personnel assigned as program managers have the authority and responsibility to implement the program and to commit adequate resources to its activities.

Inspections documented in structure walkdown inspection reports and staff inspection reports and assessments documented in self-assessments and Nuclear Assessment Section assessments show the Masonry Wall Program as implemented through the Maintenance Rule Program as critically monitored and continually improving. These operating experience results prove that the Masonry Wall Program ensures the continuing integrity of the subject walls.

During the audit and review, the staff reviewed the operating experience described in the LRA and an HNP maintenance rule self-assessment covering the period from June 30, 2003, to November 17, 2004. The staff determined the program to be effective in meeting 10 CFR 50.65 requirements with no specific deficiencies found by inspection of masonry walls. The staff reviewed corporate assessments of the Maintenance Rule Program, which included masonry walls, in 1999, 2001, and 2005 and found no issues. The staff reviewed walkdowns for structures within the scope of the maintenance rule completed in the summer of 2006 and documented in accordance with HNP procedures finding only minor cracking in the turbine building and minor mortar defects in the diesel generator building and requiring no corrective actions. The staff reviewed Inspection Report 50-400/97-07 (1997), which evaluated HNP effectiveness in implementing maintenance rule requirements. Noting no violations or deficiencies for masonry walls, the NRC inspection concluded that the program was comprehensive and effectively implemented.

On the basis of its review of plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the Masonry Wall Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A1.1.30, the applicant provided the FSAR supplement for the Masonry Wall Program. In its letter dated August 20, 2007, the applicant proposed Commitment No. 24 to enhance the Masonry Wall Program prior to the period of extended operation. The staff reviewed this section and determines that, with Commitment No. 24, the information in the FSAR 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. Also, the staff reviewed the enhancement and confirmed that their implementation through Commitment No. 24 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.24 Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.31 describes the existing Structures Monitoring Program as consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program."

The Structures Monitoring Program manages the aging effects of civil/structural commodities within the scope of license renewal. The Structures Monitoring Program is implemented, through procedures, in accordance with the regulatory requirements and guidance of the Maintenance Rule, 10 CFR 50.65; RG 1.160, Revision 2, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and NEI 93-01, Revision 2, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The program incorporates criteria recommended by INPO Good Practice Document 85-033, "Use of System Engineers," NEI 96-03, "Guidelines for Monitoring the Condition of Structures at Nuclear Plants," and inspection guidance based on industry operating experience and recommendations from American Concrete Institute (ACI) Standard 349.3R-96, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," and American Society of Civil Engineers (ASCE) 11-90, "Guideline for Structural Condition Assessment of Existing Buildings." The program periodically inspects and monitors the condition of structures and structure component supports to detect and determine the extent of aging degradation leading to loss of intended functions.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it.

Enhancements 1 through 6. The LRA states the following enhancements to the GALL Report program element "scope of the program," specifically:

(1) Administrative controls that implement the program will be revised to specifically identify the license renewal structures and systems that credit the program for aging management.

(2) Administrative controls that implement the program will be revised to require notification of the responsible engineer when below-grade concrete is exposed so an inspection may be performed prior to backfilling.

(3) Administrative controls that implement the program will be revised to require periodic groundwater chemistry monitoring designed for potential seasonal variations.

(4) Administrative controls that implement the program will be revised to define the term "structures of a system" in the system walkdown procedure and specify the condition monitoring parameters that apply to "structures of a system."

(5) Administrative controls that implement the program will be revised to include the corporate structures monitoring procedure as a reference in the plant implementing procedures and specify that forms from the corporate procedure be used for inspections.

(6) Administrative controls that implement the program will be revised to require inspection of inaccessible surfaces of concrete pipe when exposed.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 25) to enhance the program implementing procedures (1) to indicate the license renewal structures and systems that credit the program for aging management, (2) to require notification of the responsible engineer of below-grade concrete exposure for an inspection prior to backfilling, (3) to require periodic groundwater chemistry monitoring designed for potential seasonal variations, (4) to define the term "structures of a system" in the system walkdown procedure and to specify the condition monitoring parameters for "structures of a system," (5) to include the corporate structures monitoring procedure as a reference in the plant implementing procedures and to specify use of corporate procedure forms for inspections, and (6) to require inspection of inaccessible surfaces of reinforced concrete pipe exposed by removal of backfill. The staff finds these commitments acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the "scope of the program" program element.

Enhancements 7 through 9. The LRA states the following enhancements to the GALL Report program element "parameters monitored or inspected," specifically:

(7) Administrative controls that implement the program will be revised to identify additional civil/structural commodities and associated inspection attributes required for license renewal.

The applicant will revise the plant-specific structural condition monitoring procedure to include the following commodities within a condition monitoring group with the "absence of corrosion other than minor surface corrosion" performance standard:

- Phase bus enclosure assemblies
- Floor drains
- Light poles

In addition the applicant will revise the procedure to include an inspection attribute for "wood members" with a performance standard "no decay or insect infestation affecting structural properties," additional inspection guidance for friction plates (Lubrite) of "absence of excessive wear," and a performance standard of "absence of corrosion other than minor surface corrosion" for the "metal siding and trim" inspection attribute for metal siding, roof deck, and trim.

(8) Administrative controls that implement the program will be revised to require notification of the responsible engineer when below-grade concrete is exposed so an inspection may be performed prior to backfilling.

The applicant will utilize the plant-specific procedure for plant area excavation and backfill, after revision, to notify the structural systems engineer when and where below-grade concrete and concrete pipe are exposed for an inspection before backfilling.

(9) Administrative controls that implement the program will be revised to require inspection of inaccessible surfaces of concrete pipe when exposed.

The staff noted that a plant-specific Maintenance Rule structures monitoring procedure implements the existing Structures Monitoring Program. The applicant will revise the procedure to include inspection of inaccessible reinforced concrete pipe surfaces when exposed by removal of backfill for any reason.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 25) to enhance program implementing procedures (1) to indicate additional civil/structural commodities and inspection attributes required for license renewal, (2) to require notification of the responsible engineer when below-grade concrete is exposed for an inspection prior to backfilling, and (3) to require inspection of inaccessible surfaces of reinforced concrete pipe exposed by removal of backfill. The staff finds these commitments acceptable as the enhanced program implementing procedures will address GALL Report recommendations and be consistent with the "parameters monitored or inspected" program element.

On this basis, the staff finds all 9 enhancements acceptable because, when implemented, the Structures Monitoring Program will be consistent with GALL AMP XI.S6 and will assure adequate management of the effects of aging.

During the audit and review, the staff noted that the applicant will create a groundwater monitoring procedure for periodic groundwater chemistry monitoring designed for potential seasonal variations. The staff asked the applicant (1) for the dates and results at specific locations of the two most recent tests for aggressive groundwater and the scheduled frequency of groundwater monitoring, and (2) whether the Structures Monitoring Program will continue groundwater monitoring and inspection of all inaccessible areas that may be exposed by excavation whether the environment is aggressive or not.

In its response dated August 20, 2007, the applicant stated that LRA Section 3.5.2.2.1 describes groundwater sampling for license renewal in August 2005 from two wells (Well 57 - pH 7.6, chlorides 290 mg/l, sulfate 2.4 mg/l; Well 59 - pH 7.9, chlorides 42 mg/l, sulfate 2.1 mg/l). Prior groundwater sampling in 1973 was from three site wells no longer active recorded in FSAR Table 2.4.13-8 (Well 2 - pH 7.3, chlorides 23 mg/l, no sulfate reading; Well 4A - pH 7.9, chlorides 22 mg/l, no sulfate reading; Well 7A - pH 7.9, chlorides 21 mg/l, no sulfate reading). The Structures Monitoring Program will add a groundwater implementing procedure to require periodic groundwater chemistry monitoring designed for potential seasonal variations (as stated in LRA Appendix B, Section B.2.31). The monitoring will begin in five-year intervals from 2005 until the period of extended operation (for trending prior to the extended operation period) and then yearly thereafter even though the groundwater is currently nonaggressive. In addition, a Structures Monitoring Program implementing procedure enhancement will require inspection of inaccessible below-grade concrete exposed by excavation prior to backfilling, an enhancement to be continued during the period of extended operation even though the groundwater is nonaggressive.

The staff finds the applicant's response acceptable. The groundwater is currently not aggressive. The groundwater monitoring will begin with five-year intervals from 2005 until the period of extended operation for trending. During the period of extended operation the groundwater monitoring will be yearly with provision for seasonal variations. Inspections of below-grade concrete exposed by excavation also will continue during the period of extended operation even if the groundwater is nonaggressive. The applicant has demonstrated adequately monitoring of potential aging effects for below-grade concrete during the period of extended operation.

Operating Experience. LRA Section B.2.31 states that the Structures Monitoring Program incorporates INPO-recommended best practices and inspection guidance based on industry operating experience and recommendations from the ACI and the ASCE.

Review of inspection reports, self-assessments, and condition reports has concluded that the administrative controls are effective in detecting age-related degradation, implementing appropriate corrective actions, and continually upgrading structure monitoring.

During the audit and review, the staff reviewed the operating experience described in the LRA and a Maintenance Rule self-assessment for the period from June 30, 2003, to November 17, 2004, and determined that the program was effective in meeting 10 CFR 50.65 requirements. The self-assessment reported two weaknesses and five items for management consideration. One weakness in structural items in the Maintenance Rule database needed an update with the current performance group criteria. Corrective action resolved the weakness. One management consideration was a link between the system walkdown procedure and the plant-specific Maintenance Rule structures monitoring procedure to address structural deficiencies. Revision of the system walkdown procedure resolved this item.

During the audit and review, the staff reviewed 1999, 2001, and 2005 corporate Nuclear Assessment Section assessments of the Maintenance Rule Program. The assessments did not evaluate the Structures Monitoring Program specifically but did evaluate the Maintenance Rule Program, which includes structures and structures of systems. The 1999 assessment found an issue and a weakness in the Maintenance Rule Program and corrective actions improved the overall program. The 2001 and 2005 assessments found no issues or weaknesses in the Maintenance Rule Program.

During the audit and review, the staff reviewed walkdowns for structures within the scope of the Maintenance Rule completed in the summer of 2006 and documented in accordance with plant procedure. Four action requests addressed documented conditions: (1) a degraded (severely corroded) but operable safety-related conduit support in the intake structure, (2) a loose flange bolt nut (corrected) on a valve in the containment, (3) protective coating discrepancies (corrected) in the containment on Service Level I applications, and (4) cracks in the foundation pad for the B EDG silencer.

The staff reviewed NRC Inspection Report 50-400/97-07 (1997), which evaluated HNP effectiveness in implementing Maintenance Rule requirements and concluded that the program was comprehensive and effectively implemented. The NRC inspection report noted minor material conditions for structures not documented in the 1996 baseline inspections by the plant but initiated no violations or deficiencies for such structures.

During the audit and review, the staff reviewed various action requests and condition reports. Most of the documented conditions were rusted or corroded structural components (*e.g.*, pipe supports, studs, grating, and conduits). HNP corrected these conditions as well as a few from procedural and walkdown documentation errors.

On the basis of its review of plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's Structures Monitoring Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.31, the applicant provided the FSAR supplement for the Structures Monitoring Program. In its letter dated August 20, 2007, the applicant proposed Commitment No. 25 to enhance the Structures Monitoring Program prior to the period of extended operation. The staff reviewed this section and determines that, with Commitment No. 25, the information in the FSAR 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 Structures Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 25, 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.25 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program

Summary of Technical Information in the Application. LRA Section B.2.32 describes the existing RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program as consistent, with enhancements, with GALL AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants."

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program consists of inspection and surveillance to manage the aging effects of the dams and spillways, dikes, canals, reservoirs, and the intake, screening, and discharge structures of plant cooling water systems. The program was developed to meet the requirements of RG 1.127, Revision 1.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which the LRA credits it.

Enhancement 1. The LRA states the following enhancement to the GALL Report program element "parameters monitored or inspected," specifically:

> Administrative controls will be revised to document a visual inspection of the miscellaneous steel at the main dam and spillway.

During the audit and review, the staff noted that a plant-specific dam/dike/retaining wall monitoring procedure monitors dams, dikes, and related structures in the reservoir complex. The applicant will revise the procedure checklist documenting observations for the main dam and spillway for the major five-year inspection to include a visual inspection of the grating, checkered plate, and hand rail.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 26, Item No. 3) to enhance the program implementing procedure to require documentation of a visual inspection of miscellaneous steel at the main dam and spillway. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "parameters monitored or inspected" program element.

Enhancement 2. The LRA states the following enhancement to the GALL Report program element "acceptance criteria," specifically:

> Administrative controls that implement the program will be revised to require evaluation of concrete deficiencies in accordance with the acceptance criteria provided in the corporate inspection procedure.

During the audit and review, the staff noted that the RG 1.127 program implementation is through a corporate procedure for condition monitoring of structures providing the guidance and periodicity required to manage the effects of aging. Concrete acceptance criteria based on Chapter 5 of ACI 349.3R-96 are in this procedure. The plant-specific dam/dike/retaining wall monitoring procedure monitors dams, dikes, and related structures in the reservoir complex. The applicant will revise the plant-specific dam/dike/retaining wall monitoring procedure to require evaluation of concrete deficiencies in accordance with corporate acceptance criteria.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 26, Item No. 1) to enhance program implementing procedure to require evaluation of any concrete deficiencies in accordance with corporate inspection acceptance criteria. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "acceptance criteria" program element.

Enhancement 3. The LRA states the following enhancement to the GALL Report program element "corrective actions," specifically:

> Administrative controls that implement the program will be revised to require initiation of a Nuclear Condition Report (NCR) for degraded plant conditions and require, as a minimum, the initiation of an NCR for any condition that constitutes an "unacceptable" condition based on the acceptance criteria specified.

During the audit and review, the staff noted that a plant-specific dam/dike/retaining wall monitoring procedure monitors dams, dikes, and related structures in the reservoir complex. The applicant will revise the procedure to require NCRs for degraded plant conditions and require, as a minimum, an NCR for any condition unacceptable under specified criteria.

By letter dated August 20, 2007, the applicant proposed a commitment (Commitment No. 26, Item No. 2) to enhance the program implementing procedure to require NCRs for degraded plant conditions and require, as a minimum, an NCR for any condition unacceptable under specified criteria. The staff finds this commitment acceptable as the enhanced program implementing procedure will address GALL Report recommendations and be consistent with the "corrective actions" program element.

During the audit and review, the staff noted that prior to the period of extended operation one RG 1.127 program enhancement will revise the administrative controls that implement the program to require NCRs for degraded plant conditions and require, as a minimum, an NCR for any condition unacceptable under specified criteria. The staff asked the applicant to explain, as NCRs are not currently in use, how the program documents unacceptable conditions and processes them for engineering evaluation or corrective action.

In its response dated August 20, 2007, the applicant stated that a corporate corrective action program requires all employees to initiate NCRs for unacceptable conditions like deficiencies or deviations that has affected or reasonably could affect nuclear safety or quality. The RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program enhancement improves administrative procedure by clarifying the corporate requirement. This enhancement also makes the administrative procedure consistent with the corporate level procedure for the RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program.

The staff finds the applicant's response acceptable. The plant-specific operating experience shows action requests in the past have documented degraded plant conditions found in RG 1.127 inspections. The enhancement to plant-specific administrative procedures is for NCR clarification purposes and consistency with corporate level procedures.

Operating Experience. LRA Section B.2.32 states that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is implemented through a corporate procedure as well as plant-specific inspection and surveillance procedures that address age-related deterioration, degradation due to extreme environmental conditions, and the effects of natural phenomena that may affect water control structures. The procedures provide for periodic monitoring and maintenance of water control structures for timely prevention or mitigation of the consequences of age-related deterioration and degradation for assurance that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program effectively meets regulatory and procedural requirements, including periodic reviews. Qualified personnel assigned as program managers have the authority and responsibility to implement the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program and to commit adequate resources to its activities.

Corrective actions as results of inspections quarterly and every five years, monitoring of instrumentation readings, and evaluations of the data by plant personnel show the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program as critically monitored and continually improving. The staff has audited the program with satisfactory results. The two items of most importance cited by the staff were (1) removal of vegetation from water control structure areas and (2) correction of surface drainage in some locations to prevent erosion of elements of the dam. These items were completed and the process made more formal with the initiation of preventive maintenance inspections at prescribed frequencies.

These operating experience results prove that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program ensures the continuing integrity of water control structures.

During the audit and review, the staff reviewed the operating experience described in the LRA and the 1995, 2000 and 2005 five-year inspection reports for water control structures and found the inspection reports very comprehensive and detailed. The staff's primary focus of review was the most recent (2005) inspection report. The applicant had initiated an action request to develop a plan to address the recommendations from the 2005 water control structures inspection report. Some of the applicant's actions to address the inspection report findings include:

For the Main Dam:

Initiate a new 6 month preventive maintenance to address normal maintenance activities that are to be performed for the main dam structure, spillway, and retaining walls. These activities will include the intake and discharge channels and beaver control activities.

Initiate a work request to address a rock block slide on the main dam east spillway wall.

For the Auxiliary Dam:

Initiate a new 6 month preventive maintenance to address normal maintenance activities that are to be performed for the auxiliary dam structure, spillway, and retaining walls. These activities will include the emergency water intake channel.

Channels and Water Handling Structures Recommendations:
Initiate a new 6 month preventive maintenance to perform routine inspections of the channels.

From the staff's review, it was apparent that the applicant addressed the aging effects in the 2005 water control structures inspection report and the report recommendations to prevent aging of the structures.

The staff reviewed NRC Integrated Inspection Report 05000400/2005003 dated July 29, 2005, documenting a biennial inspection of the heat sink retaining dam, the ESW system health reports and work plans, the site dam reports by outside and corporate personnel, and the walkdown of the ESW intake structure and made no significant findings.

The staff reviewed NRC Integrated Inspection Report 50-400/01-04 dated October 25, 2001, documenting an inspection of the heat sink performance. The inspector walked down the ESW intake structure and the main and auxiliary dams with the system engineer and reviewed the reports on the ultimate heat sink dam inspections and made no significant findings.

The staff reviewed an NRC inspection report dated September 20, 2000, documenting the results of a dam safety audit dated July 28, 1999, of the Category I auxiliary reservoir dam. The report concluded that no actions were required for continued safety of the dam. The staff of the Federal Energy Regulatory Commission (FERC) performed the safety audit for the NRC and made no new recommendations for continuing maintenance. All recommendations from the previous 1995 FERC inspection had been addressed.

During the audit and review, the staff reviewed various action requests. Some of the documented conditions were corrosion on electrical supports in the ESW intake structure, a sudden change in piezometer water level readings, effects on the ESW discharge channel from fallen embankment material, and two inoperable main dam seepage monitors. All conditions were corrected or evaluated as acceptable.

On the basis of its review of plant-specific operating experience and discussions with the applicant's technical personnel, the staff concluded that the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program will adequately manage the aging effects for which the LRA credits it.

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.

FSAR Supplement. In LRA Section A.1.1.32, the applicant provided the FSAR supplement for the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. In its letter dated August 20, 2007, the applicant proposed Commitment No. 26 to enhance the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program prior to the period of extended operation. The staff reviewed this section and determines that, with Commitment No. 26, the information in the FSAR 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 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation by Commitment No. 26 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.26 Reactor Coolant Pressure Boundary Fatigue Monitoring Program

Summary of Technical Information in the Application. LRA Section B.3.1 describes the existing Reactor Coolant Pressure Boundary Fatigue Monitoring Program as consistent, with enhancements, with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary."

The applicant stated that theReactor Coolant Pressure Boundary Fatigue Monitoring Program includes preventive measures to mitigate fatigue cracking caused by anticipated cyclic strains in

RCPB metal components by monitoring and tracking significant thermal and pressure transients for limiting RCPB components so the fatigue design limit is not exceeded. The applicant also stated that the RCPB Fatigue Monitoring Program addresses the effects of the reactor coolant environment on component fatigue life by including within the program scope environmental fatigue evaluations of the sample locations specified in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components." These locations were evaluated by application of environmental correction factors to ASME Section III, Class 1 fatigue analyses as specified in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," and NUREG/CR-6717, "Environmental Effects on Fatigue Crack Initiation in Piping and Pressure Vessel Steels." The program triggers preventive actions, corrective actions, or both before the design limit is exceeded. The applicant further stated that it has ensured management of the effects of the reactor water environment on fatigue-sensitive locations for the period of extended operation.

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 to determine whether the AMP, with the enhancements, remained adequate to manage the aging effects for which it is credited.

Enhancements. The LRA states the following enhancements to meet the GALL Report program elements "scope of the program," "parameters monitored or inspected," "preventive actions," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions, specifically:

Scope: Expand the scope of the Program to include: (a) monitoring of selected RCPB components outside of the reactor vessel (including auxiliary system components such as the pressurizer lower header, pressurizer surge line, and CVCS piping and heat exchanger), and (b) incorporation of NUREG/CR-6260 locations analyzed for environmental effects.

Parameters Monitored/Inspected: Expand the parameters monitored to include monitoring of selected RCPB components outside of the reactor vessel as noted in Scope of Program above.

The staff reviewed these enhancements and finds them is consistent with the GALL Report. During the audit, the staff reviewed the HNP Fatigue Evaluation for License Renewal, which recommends incorporation of auxiliary components like the pressurizer lower header, pressurizer surge line, and chemical volume and control system (CVCS) piping and heat exchanger. The staff nots that the applicant included all components recommenced by the Westinghouse report. In addition, the staff finds the incorporation of NUREG/CR-6260 recommended by the GALL Report. On these bases, the staff finds the applicant's proposed enhancements, described above, acceptable.

Preventive Actions: Enhance the preventive actions to include, prior to a monitored location exceeding a Cumulative Usage Factor (CUF) limit of 1.0, evaluation of operational changes to reduce the number or severity of future transients.

The staff reviewed the applicant's proposed enhancement and finds it consistent with the GALL Report and on this basis acceptable.

Detection of Aging Effects: Enhance the Program to utilize online fatigue analysis software for the periodic updating of cumulative fatigue usage calculations for high fatigue usage RCPB (including auxiliary system) components.

During the audit, the staff asked the applicant to clarify this enhancement with information on the timing of these periodic updates and whether the cumulative usage factor (CUF) update is for all components under the Fatigue Monitoring Program or only those with stress-based fatigue monitoring.

It its response, the applicant stated:

> The current HNP Fatigue Monitoring Program requires a monthly evaluation of cyclic and transient data. When enhanced, the program will require a periodic update (at least once every 18 months) and review of monitored usage values in addition to the monthly cyclic and transient data monitored.

In addition, the applicant amended the LRA in by letter dated August 31, 2007, to reflect the periodic update (at least every 18 months), specifically revising LRA Section A.3.1.1.38 to read "(3) include a provision to utilize online fatigue analysis software for the periodic updating (not to exceed once every 18 months) of cumulative usage." In addition, the revised enhancement for detection of aging effects of this program states, "Enhance the Program to utilize online fatigue analysis software for the periodic updating (at least once every 18 months) of cumulative fatigue usage calculations for high fatigue usage RCPB (including auxiliary system) components." The staff reviewed the LRA changes and finds the periodic update (at least every 18 months) a sufficient margin to ensure that components are within design limits or will be entered into the Corrective Actions Program. On this basis, the staff finds the applicant's proposed enhancement acceptable.

Monitoring and Trending: Enhance the Program to include: (a) the NUREG/CR-6260 locations that are analyzed for environmental effects, and (b) a description of the use of the online fatigue analysis software for monitoring and trending of cumulative fatigue usage for limiting component locations.

During the audit, the staff asked the applicant to clarify this enhancement with the alarm limits of components included in the stress-based fatigue monitoring portion as well as those in the cycle-counting portion of the program.

The applicant provided two lists of locations and alarm limits. The staff noted that all cycle or transient alarm limits are set conservatively with the current cycle numbers (as stated in the LRA) a small fraction of design cycles. The staff finds the limiting component locations appropriately selected for the online software with no transients cycles for these locations left to be counted administratively. On this basis, the staff finds the applicant's proposed enhancement acceptable.

Acceptance Criteria: Enhance the Program to describe the acceptance criteria for maintaining the fatigue usage below the design code limit, taking into consideration the environmental fatigue effects for the NUREG/CR-6260 locations.

The staff reviewed this enhancement and finds it consistent with the GALL Report. On this basis, the staff finds the applicant's proposed enhancement acceptable.

Corrective Actions: Enhance the Program to address corrective actions if an analyzed component is determined to be approaching the design limit, with options to revise the fatigue analysis, repair, or replace the component.

The staff reviewed this enhancement and finds clarification was needed. During the audit, the staff asked the applicant to describe the process to inform the program owner when an alarm limit is approached and on how the process is procedurally controlled.

In its response, the applicant stated:

> When program enhancements are implemented, the program will have established alarm limits for plant cycle and transient counts and alarm limits for monitored component usage values. When alarm limits are reached, corrective actions will be taken.
>
> When alarm limits are reached, corrective actions will be taken as described above. Corrective actions are procedurally controlled by the corporate Corrective Action Program (CAP) procedure. Corrective Actions are implemented in accordance with the requirements of Appendix B to 10 CFR 50.

The staff reviewed the applicant's response and noted that the LRA does not state specifically that the Corrective Actions Program will implement the corrective actions.

By letter dated August 31, 2007, the applicant revised LRA Subsection A.1.1.38 to read: "(5) address corrective actions, to be implemented through the Corrective Action Program, for components that have exceeded alarm limits, with options to include a revised fatigue analysis or repair or replacement of the component." In addition, the applicant revised the enhancement for corrective actions of this program by adding the following sentence: " Corrective actions if required will be implemented through the HNP Corrective Action Program." The staff reviewed the revisions and finds the clarification and LRA changes will ensure management of components approaching design limits. On this basis, the staff finds the applicant's proposed enhancement acceptable.

Operating Experience. LRA Section B.3.1 states that review of NRC information notices, bulletins, and generic letters, and the INPO operating experience database found no applicable operating experience with fatigue monitoring or exceeding fatigue design limits since January 1995. The applicant stated that the program has been effective in tracking the high-fatigue usage components so they remain below the 1.0 design limit. Fatigue evaluation of the most limiting locations (*e.g.*, pressurizer surge line, pressurizer lower head, surge line hot leg nozzle, surge line cold leg nozzle, and chemical and volume control system cold leg normal charging nozzle) showed that the calculated environmentally-adjusted cumulative usage factor would remain below the 1.0 design limit for the period of extended operation.

By letter dated August 31, 2007, the applicant amended its LRA by removing the last sentence of the operating experience section. The staff reviewed the change and finds it acceptable as the sentence relating to future performance is irrelevant to operating experience.

During the audit, the staff asked the applicant how it documents the periodic updates as well as how these updates undergo peer review.

In its response, the applicant stated that

> The current (prior to enhancement) HNP Fatigue Monitoring Program requires signatures by the Shift Technical Advisor and the Superintendent, Shift Operations. The Shift Technical Advisor is responsible for the monthly evaluation of cyclic and transient data and the Superintendent, Shift Operations reviews the evaluation and cycle logs and forwards to document services to be stored as permanent records. Operations personnel provide an internal peer review to verify the monthly evaluations have been correctly completed.

The staff reviewed the response and finds that the applicant's current documentation procedures adequately account for transients.

On the basis of this review, the staff finds the applicant's proposed enhancement 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.

FSAR Supplement. In LRA Section A.1.1.38, the applicant provided the FSAR supplement for the Reactor Coolant Pressure Boundary Fatigue Monitoring Program. The staff reviewed this section and its changes made by the applicant's amendment letter dated August 31, 2007, and determines that the information in the FSAR 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 Reactor Coolant Pressure Boundary Fatigue Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation 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 FSAR 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 no AMPs as plant-specific; however, during the audit and review, the staff questioned the adequacy of aging management for the high-voltage power cables. SER Section 3.6.2.3.1 documents details of the staffs evaluation.

In its response dated August 20, 2007, the applicant amended the LRA to include a plant-specific AMP. The following section documents the staff's evaluation of the applicant's Oil-Filled Cable Testing Program.

3.0.3.3.1 Oil-Filled Cable Testing Program

During the audit and review, the staff questioned the applicant's lack of an AMP for the high-voltage oil-filled cables.

In its response dated August 20, 2007, the applicant amended the LRA with Section B.2.38, "Oil-Filled Cable Testing Program." This program will be implemented prior to the period of extended operation (Commitment No. 34 - HNP-07-112 dated August 20, 2007).

Summary of Technical Information in the Application. The LRA credits the Oil-Filled Cable Testing Program for aging management of the high-voltage, oil-filled cables which connect the 230KV switchyard to the startup transformers. The applicant stated that the periodic cable testing will proceed at least every four years to indicate the condition of the cable insulation properties. The specific test type (e.g., power factor (Doble), partial discharge, polarization index) to be determined prior to the initial test will be proven for detecting deterioration of the insulation system or other state-of-the-art testing at the time. The applicant also stated that the program will verify management of the effects of aging from a loss of dielectric strength caused by thermal/thermoxidative degradation of organics, radiation-induced oxidation (radiolysis) of organics, voltage (partial discharge), moisture, or the presence of other impurities during the period of extended operation.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed LRA Section B.2.38, "Oil-Filled Cable Testing Program," and information in LRA Amendment 1, Enclosure 2, Attachment 2 to the letter dated August 20, 2007, for adequate management of the effects of aging to maintain intended function(s) consistent with the CLB for the period of extended operation. The audit team reviewed the applicant's AMP against the AMP elements of the SRP-LR Section A.1.2.3 and SRP-LR Table 1-1 as follows:

(1) Scope of the Program - The "scope of the program" program element criterion in SRP-LR Section A.1.2.3.1 requires that the program scope include the specific structures and components addressed by this program.

LRA Section B.2.38 states for the "scope of the program" program element that this program addresses high-voltage oil-filled cables which connect the 230KV switchyard to the startup transformers.

The staff determined that the LRA indicates the specific components (high-voltage oil-filled cables) for which the program manages aging effects, satisfying SRP-LR Section A.1.2.3.1. 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 SRP-LR Section A.1.2.3.1. The staff concludes that this program element is acceptable.

(2) Preventive Actions - The "preventive actions" program element criterion of SRP-LR Section A.1.2.3.2 is that condition monitoring programs do not rely on preventive actions so preventive actions need not be provided.

LRA Section B.2.38 states for the "preventive actions" program element, that this program monitors conditions; therefore, it takes no actions to prevent or mitigate aging degradation.

The staff determined that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section B.1.2.3.2 because in this condition monitoring program there is no need for preventive actions. On this basis, the staff finds the applicant's "preventive actions" program element acceptable.

(3) Parameters Monitored or Inspected - The "parameters monitored or inspected" program element criteria in SRP-LR Section A.1.2.3.3 are:

> The parameter to be monitored or inspected should be identified and linked to the degradation of the particular structure and component intended function(s). The parameter monitored or inspected should detect the presence and extent of aging effects.

LRA Section B.2.38 states for the "parameters monitored or inspected" program element that the specific test type (*e.g.*, power factor (Doble), partial discharge, polarization index) to be determined prior to the initial test will be proven for detecting deterioration of the insulation system or other state-of-the-art testing at the time.

The parameters monitored include a loss of dielectric strength caused by thermal/ thermoxidative degradation of organics, radiation-induced oxidation (radiolysis) of organics, voltage (partial discharge), moisture, or the presence of other impurities.

The staff determined that the "parameters monitored or inspected" program element satisfies the SRP-LR Section A.1.2.3.3 criteria. Loss of dielectric strength leading to reduced IR and electrical failure are potential aging effects due to thermal/thermoxidative degradation of organics, radiation-induced oxidation (radiolysis) of organics, voltage (partial discharge), moisture, or the presence of other impurities. The HNP cables are high-voltage, oil-filled, paper-insulated, lead-sheathed, and designed for submergence for extended periods. Impregnation of the paper tape improves the insulation's electrical resistance and adds an extra layer of defense against moisture ingress. Plant-specific and industry operating experience show this design to be extremely reliable in underground applications. Periodic cable testing will assure management of the effects of aging during the period of extended operation. On this basis, the staff finds the applicant's "parameters monitored or inspected" program element acceptable.

(4) Detection of Aging Effects - The "detection of aging effects" program element criteria in SRP-LR Section A.1.2.3.4 are:

Provide information that links the parameters to be monitored or inspected to the aging effects being managed.

Describe when, where, and how program data are collected (i.e., all aspects of activities to collect data as part of the program)

Link the method for the inspection population and sample size when sampling is used to inspect a group of SCs. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.

LRA Section B.2.38 states for the "detection of aging effects" program element, that the high-voltage, oil-filled cables within the scope of this program will be tested at least every four years, an adequate period to detect aging effects before a loss of component intended function as experience shows that aging degradation is a slow process. A four-year testing interval will provide during a 20-year period multiple data points which can characterize the degradation rate. The first tests for license renewal will be completed prior to the period of extended operation.

The staff determined that this program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4. The staff also determined that the cable manufacturer's operating experience data indicate that lead sheath cables are designed for submergence for extended periods. The impregnation of the paper tape improves the insulation's electrical resistance and adds an extra layer of defense against moisture ingress. Plant-specific and industry operating experience also show this design to be extremely reliable in underground applications. As the degradation mechanism is a slow process, a four-year testing interval is adequate to monitor any potential cable degradation. During the period of extended operation, multiple data points will be available to monitor the degradation rate. On this basis, the staff finds the applicant's "detection of aging effects" program element acceptable.

(5) Monitoring and Trending - The "monitoring and trending" program element criteria in SRP-LR Section A Section A.1.2.3.5 are:

Monitoring and trending activities should be described, and they should provide predictability of the extend of degradation and thus effect timely corrective or mitigative actions.

This program element should describe how the data collected are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

LRA Section B.2.38 states for the "monitoring and trending" program element that trending actions are not included; however, trending of discrepancies (as required) is under the Corrective Action Program implemented by the HNP QA program in accordance with 10 CFR 50, Appendix B.

The staff determined that absence of trending for testing is acceptable because the test is periodic and the applicant's Corrective Action Program corrects any unacceptable equipment performance. On this basis, the staff finds the applicant's "monitoring and trending" program element acceptable.

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

(6) Acceptance Criteria - The "acceptance criteria" program element criteria in SRP-LR Section A.1.2.3.6 are:

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 SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.

LRA Section B.2.38 states for the "acceptance criteria" program element that acceptance criteria will be based on the test for this program. Acceptance criteria ensure maintenance of intended functions of the cables consistent with the CLB.

The staff determined that this program element satisfies the criteria defined in SRP-LR Section A.1.2.3.6. The staff finds it acceptable on the basis that acceptance criteria are based on the specific type of test for the cables. The applicant will follow current industry standards and vendor recommendations which, when implemented, will maintain the license renewal intended functions of the cable connections consistent with the CLB.

(7) Corrective Actions - SER Section 3.0.4 addresses the adequacy of the applicant's 10 CFR 50, Appendix B Program for this program element.

The staff reviewed this program element to determine whether it satisfies the criteria defined in SRP-LR Section A.1.2.3.7. The staff found the requirements of 10 CFR Part 50, Appendix B, acceptable for corrective action. On this basis, the staff finds the applicant's "corrective actions" program element acceptable.

(8) Confirmation Process - SER Section 3.0.4 addresses the adequacy of the applicant's 10 CFR 50, Appendix B Program for this program element.

The staff reviewed this program to determine whether it satisfies the criteria defined in SRP-LR Section A.1.2.3.8.The staff found the requirements of 10 CFR Part 50, Appendix B, acceptable for the confirmation process. On this basis, the staff finds the applicant's "confirmation process" program element acceptable.

(9) Administrative Controls - SER Section 3.0.4 addresses the adequacy of the applicant's 10 CFR Part 50, Appendix B Program for this program element.

The staff reviewed this program element to determine whether it satisfies the criteria defined in SRP-LR Section A.1.2.3.9. The staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable for administrative controls.

(10) Operating Experience - The "operating experience" program element criterion in SRP-LR Section A.1.2.3.10 that operating experience should be objective evidence of adequate management of the effects of aging to maintain structure and component intended functions during the period of extended operation.

LRA Section B.2.38 states for the "operating experience" program element that there is no plant-specific operating experience for this new program. The applicant stated that development of this program considered plant-specific and industry operating experience. This review confirms the reliability of high-voltage, oil-filled cables in underground applications; however, periodic cable testing will assure management of the effects of aging during the period of extended operation. The applicant also stated that HNP corrective action and operating experience programs will record operating experience in accordance with corporate procedures. This ongoing review of operating experience will continue throughout the period of extended operation with the results maintained on site. The applicant further state that administrative controls that implement the Corrective Action and Operating Experience Programs are in accordance with the QA program in conformance with 10 CFR 50, Appendix B. These controls will verify continued program effectiveness in the management of aging effects.

Based on review of plant-specific corrective action documents and industry operating experience, the staff determined that the high-voltage, oil-filled cables in underground applications are highly reliable with no instances of cable degradation. The staff also determined that periodic cable testing will assure management of the effects of aging and that ongoing review of operating experience and the corrective action program will continue throughout the period of extended operation. On these bases, the staff finds the applicant's operating experience program element acceptable.

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

FSAR Supplement. The applicant's FSAR supplement for the Oil-Filled Cable Testing Program is in the supplemental LRA Section A.1.1.40, which states that the Oil-Filled Cable Testing Program assures management of the aging effect of loss of dielectric strength so oil-filled cables perform intended functions for the period of extended operation.

The staff reviewed the applicant's license renewal commitment list in LRA Amendment No. 1 dated August 20, 2007, and confirmed that this new program is Commitment No. 34 to be implemented before the period of extended operation. The staff reviewed LRA Appendix A.1.1.40 and determined that the information in the FSAR 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 Oil-Filled Cable Testing Program, the staff concludes that the applicant has demonstrated adequate program management of the effects of aging to maintain intended functions consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).The staff also reviewed the FSAR supplement for this AMP and concludes that, with Commitment No. 34, it is an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 QA Program Attributes Integral to Aging Management Programs

Pursuant to 10 CFR 54.21(a)(3), the applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation. SRP-LR Branch Technical Position (BTP) RLSB-1, "Aging Management Review – Generic," describes ten elements of an acceptable AMP. Elements (7), (8), and (9) are associated with the QA activities of "corrective actions," "confirmation process," and "administrative controls." BTP RLSB-1 Table A.1-1, "Elements of an Aging Management Program for License Renewal," provides the following description of these program elements:

(7) Corrective Actions – Corrective actions, including root cause determination and prevention of recurrence, should be timely.

(8) Confirmation Process – The confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions are completed and effective.

(9) Administrative Controls – Administrative controls should provide for a formal review and approval process.

BTP IQMB-1, “Quality Assurance for Aging Management Programs,” notes that AMP aspects that affect the quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50 Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant may use the existing 10 CFR Part 50 Appendix B QA program to address the elements of “corrective actions,” “confirmation process,” and “administrative controls.” BTP IQMB-1 provides the following guidance on the QA attributes of AMPs:

- Safety-related SCs are subject to 10 CFR Part 50 Appendix B 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, an applicant has an option to expand the scope of its 10 CFR Part 50 Appendix B program to include these SCs to address “corrective action,” “confirmation process,” and “administrative controls” for aging management during the period of extended operation. In this case, the applicant should document such commitment in the FSAR supplement in accordance with 10 CFR 54.21(d).

3.0.4.1 Summary of Technical Information in the Application

LRA Section B.1.3, “Quality Assurance Program and Administrative Controls,” describes the elements of corrective action, confirmation process, and administrative controls applied to the AMPs for both safety-related and nonsafety-related components. The HNP QA program, described in FSAR Section 17.3, implements the requirements of 10 CFR Part 50, Appendix B. The Corrective Action Program applies corrective actions, confirmation, and administrative controls regardless of component safety classification. Specifically, LRA Section B.1.3 states that the QA program implements the requirements of 10 CFR Part 50, Appendix B. LRA Section B.2, “Aging Management Programs,” summarizes the AMPs.

3.0.4.2 Staff Evaluation

The staff reviewed the applicant's AMPs as described in LRA Appendix A, “Final Safety Analysis Report Supplement,” and LRA Appendix B, “Aging Management Programs,” and each AMP basis document for consistency in the use of the QA attributes for each program. This review was for the aging management consistent with staff guidance of SRP-LR Section A.2, “Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1).”

The staff's evaluation determined that the descriptions and applicability of plant-specific AMPs and their quality attributes described in LRA Section B1.3 were generally consistent with the staff position on QA for aging management. The AMP description B2.8 in LRA Appendix B refers to “Exceptions to NUREG 1801" and indicates an exception to the “corrective actions” area, however, there is no indication or description of the use of any alternative method to the HNP 10 CFR Part 50, Appendix B QA Program.

The staff's review of LRA Section B.1.3 found an area in which additional information was necessary to complete the review of the applicant's program elements. The applicant responded to the staff's RAI as discussed below.

In RAI 3.0-1 dated June 11, 2007, the staff requested from the applicant the following information to address these issues:

- A supplement to the description in LRA Section A1 clearly indicating application of the 10 CFR Part 50, Appendix B, QA program or an alternative for the "corrective action," "confirmation process," and "administrative controls" elements of each program. Describe any alternative approaches to the application of the 10 CFR Part 50, Appendix B, QA program in sufficient detail for the staff to determine whether the quality attributes for the AMPs are consistent with the review acceptance criteria of SRP-LR, Section A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)."

- For AMPs described in LRA Appendix B taking exceptions to "corrective actions," "confirmation process," or "administrative controls," indicate whether the exceptions include an alternative to the application of the HNP 10 CFR Part 50, Appendix B QA program as described in Section B.1.3. Describe any alternative approaches in sufficient detail for the staff to determine whether the quality attributes for the AMPs are consistent with the review acceptance criteria of SRP-LR, Section A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)."

In its response dated July 10, 2007, the applicant indicated that the exception to "corrective actions" for the Bolting Integrity Program was to indicate the difference in the ASME Code edition specified in the GALL Report and the edition of record which the applicant has committed to use. The Bolting Integrity Program will apply the HNP QA program and the requirements of 10 CFR Part 50, Appendix B, to the area of "corrective actions" as stated in LRA Section B.1.3.

Based on its review, the staff finds the applicant's commitment to apply 10 CFR Part 50, Appendix B, to "corrective actions" for the Bolting Integrity Program acceptable. The staff's concern described in RAI 3.0-1 is resolved.

3.0.4.3 Conclusion

The staff's evaluation found the descriptions and applicability of the plant-specific AMPs and their quality attributes described in LRA Sections B.1.3 and B.2 and the RAI response consistent with the staff position on QA for aging management. The staff concludes that the QA attributes ("corrective action," "confirmation process," and "administrative controls") of the applicant's AMPs are consistent with 10 CFR 54.21(a)(3).

3.1 Aging Management of Reactor Vessel, 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 reactor vessel, reactor vessel internals (RVI), and reactor coolant system components and component groups of:

- reactor vessel and internals
- incore instrumentation system
- reactor coolant system
- reactor coolant pump and motor
- pressurizer
- steam generator

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the reactor vessel, RVI, and reactor coolant system components and component groups. LRA Table 3.1.1, "Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Vessels, Internals, and Reactor Coolant System," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the reactor vessel, RVI, and reactor coolant system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience 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 operating experience included a review of the GALL Report and operating experience 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 reactor vessel, RVI, 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 verify 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 operating experience 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 reactor vessel 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	Not applicable	Not applicable to PWRs (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; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor coolant pressure boundary 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	Not applicable	Not applicable to PWRs (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 PWRs (See SER Section 3.1.2.2.1)
Stainless steel and nickel alloy reactor vessel 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 feedwater/steam environment (3.1.1-6)	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 and stainless steel reactor coolant pressure boundary 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	TLAA	Fatigue is a TLAA (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; stainless steel; and nickel-alloy reactor coolant pressure boundary 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	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 reactor vessel 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	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 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	TLAA	Fatigue is a TLAA (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	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.2.1)
Steel steam generator shell assembly exposed to secondary feedwater 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 HNP (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 PWRs (See SER Section 3.1.2.2.2.2)
Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel 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	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.2.3)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary 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	Not applicable	Not applicable to PWRs (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
Steel steam generator upper and lower shell and transition cone exposed to secondary feedwater 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	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B2.1) and Water Chemistry (B2.2)	Consistent with the GALL Report with exception (See SER Section 3.1.2.2.2.4)
Steel (with or without stainless steel cladding) reactor vessel 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 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) reactor vessel 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 (B2.1.17)	Consistent with the 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 stress corrosion cracking and intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.4.1)
Stainless steel isolation condenser components exposed to reactor coolant (3.1.1-20)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.4.2)

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
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 HNP (See SER Section 3.1.2.2.5)
Stainless steel and nickel alloy reactor vessel internals components exposed to reactor coolant and neutron flux (3.1.1-22)	Loss of fracture toughness due to neutron irradiation embrittlement, void swelling	FSAR 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	FSAR Supplement Section A.1.1	Consistent with the GALL Report (See SER Section 3.1.2.2.6)
Stainless steel reactor vessel closure head flange leak detection line and bottom-mounted instrument guide tubes (3.1.1-23)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry (B.2.2) and One-Time Inspection (B.2.18)	Consistent with the GALL Report (See SER Section 3.1.2.2.7.1)
Class 1 cast austenitic stainless steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-24)	Cracking due to stress corrosion cracking	Water Chemistry and, for CASS components that do not meet the NUREG-0313 guidelines, a plant-specific AMP	Yes	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1) and Water Chemistry (B.2.2)	Consistent with the GALL Report (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	Not applicable	Not applicable to PWRs (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	Not applicable to PWRs (See SER Section 3.1.2.2.8.2)
Stainless steel and nickel alloy reactor vessel internals screws, bolts, tie rods, and hold-down springs (3.1.1-27)	Loss of preload due to stress relaxation	FSAR 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	FSAR Supplement Section A.1.1	Consistent with the GALL Report (See SER Section 3.1.2.2.9)
Steel steam generator feedwater impingement plate and support exposed to secondary feedwater (3.1.1-28)	Loss of material due to erosion	A plant-specific aging management program is to be evaluated.	Yes	One-Time Inspection (B.2.18)	Consistent with the GALL Report (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	Not applicable	Not applicable to PWRs (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 reactor vessel 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 stress corrosion cracking, irradiation-assisted stress corrosion cracking	Water Chemistry and FSAR 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	Water Chemistry (B.2.2) and FSAR Supplement Section A.1.1	Consistent with the GALL Report (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 reactor vessel 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 stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and FSAR 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	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B2.1), Water Chemistry (B.2.2), and FSAR Supplement Section A.1.2	Consistent with the GALL Report (See SER Section 3.1.2.2.13)
Steel steam generator feedwater inlet ring and supports (3.1.1-32)	Wall thinning due to flow-accelerated corrosion	A plant-specific aging management program is to be evaluated.	Yes	One-Time Inspection (B.2.18)	Consistent with the GALL Report (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 reactor vessel internals components (3.1.1-33)	Changes in dimensions due to void swelling	FSAR 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	FSAR Supplement Section A.1.1	Consistent with the GALL Report (See SER Section 3.1.2.2.15)
Stainless steel and nickel alloy reactor control rod drive head penetration pressure housings (3.1.1-34)	Cracking due to stress corrosion cracking and primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and for nickel alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1) and Water Chemistry (B.2.2)	Consistent with the GALL Report (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 stress corrosion cracking and primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and for nickel alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No	Not applicable	Not applicable to HNP (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 stress corrosion cracking and primary water stress corrosion cracking	Water Chemistry and One-Time Inspection and, for nickel alloy welded spray heads, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No	Water Chemistry (B2.2) and One-Time Inspection (B.2.18)	Consistent with the GALL Report (See SER Section 3.1.2.2.16.2)
Stainless steel and nickel alloy reactor vessel 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 stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Water Chemistry and FSAR 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	Water Chemistry (B.2.2) and FSAR Supplement Section A.1.1	Consistent with the GALL Report (See SER Section 3.1.2.2.17)
Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant (3.1.1-38)	Cracking due to cyclic loading	BWR Control Rod Drive Return Line Nozzle	No	Not applicable	Not applicable to PWRs
Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant (3.1.1-39)	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	Not applicable	Not applicable to PWRs

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 control rod drive stub tubes instrumentation, jet pump instrumentation, standby liquid control, flux monitor, and drain line exposed to reactor coolant (3.1.1-40)	Cracking due to stress corrosion cracking, Intergranular stress corrosion cracking, cyclic loading	BWR Penetrations and Water Chemistry	No	Not applicable	Not applicable to PWRs
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 stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant (3.1.1-42)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel ID Attachment Welds and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant (3.1.1-43)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs

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 core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes (3.1.1-44)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs
Steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-45)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to PWRs
Nickel alloy core shroud and core plate access hole cover (mechanical covers) (3.1.1-46)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel-alloy reactor vessel 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	Not applicable to PWRs
Steel and stainless steel Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-48)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (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	Not applicable	Not applicable to PWRs

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 core shroud and core plate access hole cover (welded covers) (3.1.1-49)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	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	Not applicable	Not applicable to PWRs
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 stress corrosion cracking and intergranular stress corrosion cracking	Reactor Head Closure Studs	No	Not applicable	Not applicable to PWRs
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	Not applicable	Not applicable to PWRs
Steel and stainless steel reactor coolant pressure boundary (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 stress corrosion cracking, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity (B.2.8)	Consistent with the 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	Closed-Cycle Cooling Water System (B.2.11)	Consistent with 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
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 HNP (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, inservice inspection requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1)	Consistent with the GALL Report
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 HNP (See SER Section 3.1.2.1.1)
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) (3.1.1-57)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to HNP (See SER Section 3.1.2.1.1)
Steel reactor coolant pressure boundary 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	Boric Acid Corrosion (B.2.4)	Consistent with 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 steam generator steam nozzle and safe end, feedwater nozzle and safe end, AFW nozzles and safe ends exposed to secondary feedwater/steam (3.1.1-59)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Flow-Accelerated Corrosion (B.2.7)	Consistent with the GALL Report
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	Flux Thimble Tube Inspection (B.2.23)	Consistent with the GALL Report
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 HNP (See SER Section 3.1.2.1.1)
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 HNP (See SER Section 3.1.2.1.1)
Steel reactor vessel flange, stainless steel and nickel alloy reactor vessel 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	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1)	Consistent with 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
Stainless steel and steel with stainless steel or nickel alloy cladding pressurizer components (3.1.1-64)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1) and Water Chemistry (B.2.2)	Consistent with the GALL Report
Nickel alloy reactor vessel upper head and control rod drive penetration nozzles, instrument tubes, head vent pipe (top head), and welds (3.1.1-65)	Cracking due to primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1), Water Chemistry (B.2.2), and Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors (B.2.5)	Consistent with the GALL Report
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 HNP (See SER Section 3.1.2.1.1)
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 HNP (See SER Section 3.1.2.1.1)

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, 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 stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1) and Water Chemistry (B.2.2)	Consistent with the GALL Report
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 stress corrosion cracking, primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1) and Water Chemistry (B.2.2)	Consistent with the GALL Report
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 stress corrosion cracking, 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	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1), Water Chemistry (B.2.2), and One-Time Inspection Of ASME Code Class 1 Small-Bore Piping (B.2.21)	Consistent with 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
High-strength low alloy steel closure head stud assembly exposed to air with reactor coolant leakage (3.1.1-71)	Cracking due to stress corrosion cracking; loss of material due to wear	Reactor Head Closure Studs	No	Reactor Head Closure Studs (B.2.3)	Consistent with the GALL Report
Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater/steam (3.1.1-72)	Cracking due to OD stress corrosion cracking and intergranular attack, loss of material due to fretting and wear	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity (B.2.9) and Water Chemistry (B.2.2)	Consistent with the GALL Report
Nickel alloy steam generator tubes, repair sleeves, and tube plugs exposed to reactor coolant (3.1.1-73)	Cracking due to primary water stress corrosion cracking	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity (B.2.9) and Water Chemistry (B.2.2)	Consistent with the GALL Report
Chrome plated steel, stainless steel, nickel alloy steam generator anti-vibration bars exposed to secondary feedwater/steam (3.1.1-74)	Cracking due to stress corrosion cracking, loss of material due to crevice corrosion and fretting	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity (B.2.9) and Water Chemistry (B.2.2)	Consistent with the GALL Report
Nickel alloy once-through steam generator tubes exposed to secondary feedwater/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 HNP (See SER Section 3.1.2.1.1)
Steel steam generator tube support plate, tube bundle wrapper exposed to secondary feedwater/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 HNP (See SER Section 3.1.2.1.1)

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
Nickel alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater/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 HNP (See SER Section 3.1.2.1.1)
Steel steam generator tube support lattice bars exposed to secondary feedwater/steam (3.1.1-78)	Wall thinning due to flow-accelerate d corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to HNP (See SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes exposed to secondary feedwater/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 HNP (See SER Section 3.1.2.1.1)
Cast austenitic stainless steel reactor vessel 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	Thermal Aging and Neutron Irradiation Embrittlement of CASS (B.2.6)	Consistent with 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
Nickel alloy or nickel-alloy clad steam generator divider plate exposed to reactor coolant (3.1.1-81)	Cracking due to primary water stress corrosion cracking	Water Chemistry	No	Water Chemistry (B.2.2)	Consistent with the GALL Report
Stainless steel steam generator primary side divider plate exposed to reactor coolant (3.1.1-82)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable	Not applicable to HNP (See SER Section 3.1.2.1.1)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor vessel internals and reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-83)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry (B.2.2)	Consistent with the GALL Report
Nickel alloy steam generator components such as, secondary side nozzles (vent, drain, and instrumentation) exposed to secondary feedwater/steam (3.1.1-84)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection or Inservice Inspection (IWB, IWC, and IWD).	No	Not applicable	Not applicable to HNP (See SER Section 3.1.2.1.1)
Nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.1.1-85)	None	None	No	None	Consistent with 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
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 the GALL Report
Steel piping, piping components, and piping elements in concrete (3.1.1-87)	None	None	No	Not applicable	Not applicable to HNP

The staff's review of the reactor vessel, RVI, 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 reactor vessel, RVI, 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 reactor vessel, RVI, and reactor coolant system components:

- ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Water Chemistry Program
- Reactor Head Closure Studs Program
- Boric Acid Corrosion Program
- Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head of Pressurized Water Reactors Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Flow-Accelerated Corrosion Program
- Bolting Integrity Program
- Steam Generator Tube Integrity Program

- Closed-Cycle Cooling Water System Program
- Reactor Vessel Surveillance Program
- One-Time Inspection Program
- One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program
- External Surfaces Monitoring Program
- Lubricating Oil Analysis Program

LRA Tables 3.1.2-1 through 3.1.2-6 summarize AMRs for the reactor vessel, RVI, 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's evaluation follows.

3.1.2.1.1 AMR Results Identified as Not Applicable

AMR line items in GALL Report Volume 2, Table 1, items 10, 35, 59, 66, 75, 84, apply only to the extent that the corresponding GALL Report AMR result lines do not apply to once-through steam generators. The LRA states that because HNP has recirculating, not once-through steam generators, those line items do not apply to HNP steam generators. The staff reviewed the documentation supporting the applicant's AMR evaluations and confirmed the applicant's statement that HNP has no once-through steam generators. On this basis, the staff agrees with the applicant's determination that the GALL Report AMR item for once-through steam generators does not apply.

LRA Table B-1 states that, based on a thermal aging susceptibility evaluation, CASS components are not susceptible to thermal aging; therefore, GALL AMP XI.M12 does not apply. Further, LRA Table 3.1.1, item 3.1.1-57, states that the subject components have been screened and found to be not susceptible to thermal aging embrittlement based on the information provided in a letter from C. I. Grimes dated May 19, 2000.

Acceptable screening criteria for susceptibility to thermal aging applicable to all primary pressure boundary and RVI are outlined in the letter from C. I. Grimes dated May 19, 2000. From this letter, the susceptibility of CASS components can be determined by molybdenum content, casting method, and ferrite content. During the audit, the staff asked the applicant to describe the casting method, molybdenum content, and ferrite content for HNP components and explain why GALL AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)" program does not apply.

In its response dated August 20, 2007, the applicant stated that:

> Per Table 3 of the Grimes Letter, valve bodies and pump casings do not require a susceptibility evaluation because both susceptible and non-susceptible components are examined to ASME Section XI requirements. As shown on page 3.1-62 of the LRA, CASS components of the reactor vessel internals are managed by the Thermal Aging

and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program for loss of fracture toughness due to thermal embrittlement. The remaining population of CASS components that require a susceptibility review included the reactor coolant loop elbows and the pressurizer spray head. The d-ferrite level for the reactor coolant loop elbows was calculated as part of the leak-before-break evaluation performed in WCAP-14549-P, Addendum 1, Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for the Harris Nuclear Plant for the License Renewal Program. The reactor coolant loop elbows are low-molybdenum statically cast components. Since the maximum calculated d-ferrite level is ≤ 20 percent, the elbows are not susceptible to thermal aging. For the pressurizer spray head, the Certified Material Test Report (CMTR) information was reviewed and the d-ferrite level calculated. The resultant d-ferrite level was below the screening threshold regardless of casting method; therefore, the pressurizer spray head is not susceptible to thermal aging.

Since the population of components reviewed for thermal aging were shown not to be susceptible to thermal aging, the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is not required for license renewal.

The staff reviewed specific details of the material composition and casting methods during the audit and found the applicant's evaluation of the CASS components for susceptibility to thermal aging acceptable because the applicants molybdenum content, casting method, and ferrite content are in accordance with the staff's position in the C. I Grimes letter dated May 19, 2000. The staff also agreed with the applicant that the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program does not apply because HNP CASS components are not susceptible to thermal aging.

LRA Table 3.1.1, item 54 states that this item does not apply; however, the staff noted that GALL Report item IV.C2-11, corresponding to the GALL Report Table 1, item 54, shows loss of material due to pitting, crevice, and galvanic corrosion as an aging effect for copper alloy piping, piping components, and piping elements in closed-cycle cooling water environments. The GALL Report recommends GALL AMP XI.M21, "Closed-Cycle Cooling Water System," to manage this aging effect. During the audit, the staff asked the applicant to explain why a comparable line item for this material, environment, aging effects, and aging management program (MEAP) is not in the LRA tables.

In its response dated August 20, 2007, the applicant stated that the reactor coolant pump lube oil coolers include copper alloy tubing in a component cooling water system (closed-cycle cooling water) environment; however, the tubing is of a copper nickel alloy with less than 15 percent zinc. Loss of material due to pitting and crevice corrosion is not present because these mechanisms do not affect such copper alloys. Loss of material due to galvanic corrosion is not present because the copper alloy tubing is not in contact with a material higher in the galvanic series; therefore, there are no aging effects for this material-environment and it is not appropriate to align this component with GALL Report, Volume 2, item IV.C2-11. The applicant further confirmed that no other RCS component has this material-environment combination.

The staff reviewed the documentation supporting the applicant's AMR evaluation of cooper alloy tubing materials for reactor coolant pump oil coolers, confirmed that the tubing material is a copper nickel alloy with less than 15 percent zinc, and found the applicant's claim that loss of material due to pitting, crevice, and galvanic corrosion is not present for this component acceptable. On this basis, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report does not apply.

LRA Table 3.1.1, item 56 shows that this item does not apply; however, GALL Report, Volume 2, item IV.C2-12, corresponding to GALL Report Volume 1, Table 1, item 56, shows loss of material due to selective leaching as an aging effect for copper alloy with less than 15 percent zinc in piping, piping components, and piping elements in closed-cycle cooling water environments. The GALL Report recommends GALL AMP XI.M33, "Selective Leaching of Materials," to manage this aging effect. During the audit, the staff asked the applicant to explain why a comparable line item for this MEAP is not in the LRA tables.

In its response dated August 20, 2007, the applicant stated that there is no copper alloy with less than 15 percent zinc in closed-cycle cooling water environments within the systems evaluated in Chapter IV of the GALL Report; thus, GALL Report, Volume 2, item IV.C2-12 does not apply. The staff finds the response acceptable as it confirms that HNP has no copper alloy component with less than 15 percent zinc in a closed-cycle cooling water environment. On this basis, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report does not apply.

LRA Table 3.1.1, items 61 and 62 show that this item does not apply; however, the staff noted that GALL Report item IV.C2-16, corresponding to GALL Report Table 1, item 61, shows cracking due to cyclic loading as an aging effect for stainless steel or steel pressurizer integral supports in air with metal temperature up to 288 °C (550 °F). The GALL Report recommends GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," to manage this aging effect for Class 1 components in the line-items corresponding to GALL Report Table 1, items 61, 62, and 67.

During the audit, the staff asked the applicant to explain why a comparable line item for this MEAP is not in the LRA tables.

In its response dated August 20, 2007, the applicant stated that cracking due to cyclic loading does not affect this specific pressurizer subcomponent; however, the ASME Inservice Inspection, Subsections IWB, IWC, and IWD Program manages the cracking aging effect for the pressurizer. The staff noted that cracking aging effect for components in Table 3.1.1, line-items 61, 62, and 67 is addressed in line item 68 and managed adequately by the ASME Inservice Inspection, Subsections IWB, IWC, and IWD Program; therefore, the staff finds the applicant's response acceptable.

The staff noted that GALL Report item IV.A2-25 shows loss of material due to wear as an aging effect for vessel shell flanges made of steel material in reactor coolant environments. The GALL Report recommends GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components to manage this aging effect. This line corresponds to GALL Report Table 1, item 63. During the audit, the staff asked the applicant to explain why a comparable line item for this MEAP is not in the LRA tables.

In its response dated August 20, 2007, the applicant stated that the AMR included operating experience and found no history of wear on the reactor flanges; therefore, wear is not an aging effect for this component. The applicant, however, credits the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program in LRA Table 3.1.2-1 to manage SCC for this component. On the basis of the plant-specific operating experience, the staff finds the applicant's response acceptable.

LRA Table 3.1.2-6 shows SCC, loss of material due to crevice corrosion, and loss of material due to pitting corrosion as aging effects for stainless steel steam generator tube support plates and flow distribution baffles in treated water (outside) environments. The LRA credits the Steam Generator Tube Integrity Program and the Water Chemistry Program for managing these aging effects. Although the LRA uses Note F, which means the material is not in the GALL Report for this component, it refers to GALL Report item IV.D-17. Further, this reference is not consistent with LRA Table 3.1.1, item 3.1.1-76 showing that ligament cracking due to corrosion of the steel steam generator tube support plate (Unique Item IV.D1-17) is not present and that all tube support plates are made of Type 405 ferritic stainless steel. During the audit, the staff asked the applicant to clarify this discrepancy with supporting documents and basis to demonstrate how the Steam Generator Tube Integrity and Water Chemistry Programs will manage the aging effects for stainless steam generator tube support plates and flow distribution baffles in treated water.

In its response dated August 20, 2007, the applicant stated that the material for these components is "stainless steel." The GALL Report item IV.D1-17 shows the material for the line item as "steel." As defined in GALL AMP IX.C, "steel" does not include "stainless steel;" therefore, as the HNP material is not in the GALL Report for this component, Note "F" is appropriate is consistent with LRA Table 3.1.1, item 3.1.1-76. The staff finds the applicant's response acceptable because it explained that HNP steam generator tube support plate material is stainless steel and that the MEAP corresponding to GALL Report item IV.D1-17 does not apply.

The applicant further clarified that the aging management strategy for these components (steam generator secondary side components fabricated from carbon or low-alloy steel and exposed treated water) includes the Water Chemistry Program and Steam Generator Tube Integrity Program. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the loss of material and cracking aging effects. The Steam Generator Tube Integrity Program manages aging effects by a balance of prevention, inspection, evaluation, repair, and leakage monitoring. The staff's evaluation of the applicant's Water Chemistry Program is documented in SER Section 3.0.3.1.1, the staff's evaluation of the applicant's Steam Generator Tube Integrity Program in SER Section 3.0.3.2.6. On these bases, the staff agrees with the applicant that the loss of material aging effect for carbon steel and low-alloy steel steam generator components will be adequately managed during the period of extended operation.

LRA Table 3.1.1, item 77 shows that this item does not apply. HNP does not use phosphate chemistry. On the basis that the staff verified that HNP does not use phosphate chemistry in its feedwater-steam environment, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report does not apply.

LRA Table 3.1.1, item 78 shows that the corresponding AMR result line in the GALL Report does not apply because the steam generators have no lattice bars. On the basis that the staff verified that the HNP has no lattice bars in its steam generators, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report does not apply.

LRA Table 3.1.1, item 79 shows that the corresponding AMR result line in the GALL Report does not apply because all tube support plates are made of Type 405 ferritic stainless steel. During the audit, the staff verified that the tube support plates are made of Type 405 ferritic stainless steel and that all tube support plates feature a flat contact geometry to reduce the tube-to-tube support plate crevice area. On these bases the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report does not apply.

LRA Table 3.1.1, item 82 shows that the corresponding AMR result line in the GALL Report does not apply because the steam generator primary side divider plate is fabricated from thermally-treated Alloy 690. On the basis that HNP has no stainless steel as a material of construction for its steam generator primary side divider plate, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report does not apply.

The staff noted that FSAR Section 4.5.1.1, "Materials Specifications," states that all parts of the control rod dive mechanism (CRDM) exposed to reactor coolant are made of metals which resist the corrosive action of the water. Three types of materials used exclusively are stainless steel, nickel-chromium-iron, and cobalt-based alloys. Further, FSAR Section 4.5.1.1 refers to other materials (Haynes 25, Inconel X-750, ductile iron, and Dow Corning 302) for the coil stack assembly and latch assembly; however, most of these materials, except stainless steel, are not in LRA tables for the CRDM assembly. During the audit, the staff asked the applicant to explain why these CRDM materials are not in LRA Section 3.1.

In its response dated August 20, 2007, the applicant stated that "only the subcomponents of the CRDM having component intended functions were evaluated in the AMR. Active subcomponents are excluded from review based on 10 CFR 54.21(a)(1)(i). As stated in FSAR Section 4.5.1.1(a), 'All pressure containing materials of the CRDM comply with Section III of the ASME Boiler and Pressure Vessel Code, and are fabricated from austenitic (Type 304) stainless steel.' The pressure boundary components of the CRDM include only the 'CRDM Latch Housings' and the 'CRDM Rod Travel Housings' which are identified in FSAR Table 5.2.3-1 as type 304 stainless steel."

The staff finds the applicant's response acceptable because it clarifies that the CRDM subcomponents with materials other than stainless steel have no intended functions and, therefore, are not addressed in the AMR reviews.

3.1.2.1.2 Cracking Due to SCC, Loss of Material Due to Wear, and Loss of Preload

In reviewing LRA Table 3.1.1, item 52, the staff noted that GALL Report items IV.A2-6, IV.A2-7, and IV.A2-8 show SCC, loss of material due to wear, and loss of preload as aging effects for stainless steel control rod drive head penetration flange bolting in air with reactor coolant leakage environments. The GALL Report recommends GALL AMP XI.M18, "Bolting Integrity," for managing these aging effects. These lines correspond to GALL Report Table 1, item 52. During the audit, the staff asked the applicant to explain why comparable line items for these GALL Report items are not in the LRA tables.

In its response dated August 20, 2007, the applicant stated that the HNP reactor vessel head has 65 CRDM head penetration nozzles. Of these, 52 CRDM penetrations are for actual CRDMs, four are for the core exit thermocouples, eight spare CRDM penetrations are capped with head adapter plugs, and one spare is for reactor vessel level indicator/switch piping. The top of each CRDM head penetration flange welded to top of each CRDM head penetration nozzle is threaded externally (male) to receive an internally-threaded (female) CRDM assembly, core exit thermocouple assembly, head adapter plug, or reactor vessel level indicator/switch adapter. These components are seal-welded to the head penetration flanges. No bolted flange is used for any of these locations; therefore, GALL Report, Volume 2, items IV.A2-6, IV.A2-7, and IV.A2-8 do not apply. The staff finds the applicant's response acceptable because it explained that HNP uses no bolted flange for comparable GALL Report items in Table 1, item 52 and these line items do not apply.

3.1.2.1.3 Loss of Material Due to General, Crevice, and Pitting Corrosion

In reviewing LRA Table 3.1.2-4, the staff noted that it shows loss of material due to general, crevice, and pitting corrosion for carbon steel reactor coolant pump (RCP) oil cooler/heat exchanger components in treated water environments and that it credits the Closed-Cycle Cooling Water Program (LRA Section B.2.11) to manage this aging effect. The LRA shows consistency with GALL Report item IV.C2-14 and GALL Report Table 1, item 53. The LRA uses Note B, indicating that the program has an exception to the GALL Report program.

Further, LRA Section B.2.11, "Closed-Cycle Cooling Water System Program," under the program elements affected by the exception states that:

- Parameters monitored or inspected

  Some heat exchangers are not monitored for flow, inlet and outlet temperatures, and differential pressure. In these cases, either the functionality of these heat exchangers is verified by activities outside the Closed-Cycle Cooling Water Program or the specific operating conditions of the heat exchanger render performance testing unreliable.

- Detection of aging effects

Some heat exchangers that are not normally in operation are not periodically tested to ensure operability; however, the functionality of these heat exchangers is verified by activities outside the Closed-Cycle Cooling Water Program.

During the audit, the staff asked the applicant to clarify whether this exception affects the RCP oil cooler/heat exchanger and, if so, to explain verification of the functionality of these heat exchangers.

In its response dated August 20, 2007, the applicant stated that the RCP oil cooler/heat exchanger component intended function is pressure boundary and that these components maintain pressure boundary integrity of the component cooling water system. The applicant concluded that verification of functionality as to heat transfer is not required. The staff finds the response acceptable because it explained that functionality tests are not required for managing loss of material due to general, crevice, and pitting corrosion for the RCP oil cooler/heat exchanger components and the LRA Section B.2.11 exception does not affect these components.

3.1.2.1.4 Loss of Material Due to Flow Accelerated Corrosion

In reviewing LRA Table 3.1.2-6, the staff noted that the LRA shows loss of material due to FAC as an aging effect *for the internal surfaces of feedwater nozzle fabricated from carbon or* low-alloy steel in treated water. The LRA uses Note A indicating consistency with GALL Report Table 1, item 59 (the LRA listed 3.3.1-59, apparently a typographic error) and GALL Report item IV.D1-5, which shows wall thinning due to FAC. The staff asked the applicant to explain why the LRA shows an aging effect inconsistent with the GALL Report for this line item. Also, the staff noted that LRA Table 3.1.1, item 59 shows the steam generator steam nozzle and auxiliary feedwater nozzle as not susceptible to this aging effect. The staff asked the applicant for bases for this determination.

In its response dated August 20, 2007, the applicant stated that HNP considers the aging effects wall thinning and loss of material equivalent as to FAC. The applicant amended the LRA to correct the typographical error "3.3.1-59." The staff finds this response acceptable because the applicant clarified that it considers wall thinning due to FAC equivalent to loss of material due to FAC.

3.1.2.1.5 Cracking Due to Intergranular Attack

In reviewing LRA Table 3.1.1, item 72, the staff noted that GALL Report item IV.D1-22 corresponding to the GALL Report Table 1, item 72, shows cracking due to intergranular attack as an aging effect for nickel-alloy steam generator tubes and sleeves in secondary feedwater/steam environments. The GALL Report recommends GALL AMP XI.M19, "Steam Generator Tubing Integrity," and GALL AMP XI.M2, "Water Chemistry," for PWR secondary water to manage this aging effect. During the audit, the staff asked the applicant to explain why a comparable line item for this MEAP is not in the LRA tables.

In its response dated August 20, 2007, the applicant stated that, for purposes of the AMR, the AMR methodology for predicting the cracking aging effect does not distinguish between this intergranular attack and IGSCC but records both AERMs as SCC. The applicant added that HNP manages this AERM by a combination of the Steam Generator Tube Integrity Program and the Water Chemistry Program, which is aligned to GALL Report item IV.D1-20, and that the HNP proposed AMPs are consistent with the AMPs recommended in GALL Report item IV.D1-22. The staff finds this response acceptable because the applicant clarified that the aging effect for this component is consistent with the GALL Report.

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).

3.1.2.2 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 reactor vessel, RVI, 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
- SCC and IGSCC
- crack growth due to cyclic loading
- loss of fracture toughness due to neutron irradiation embrittlement and void swelling
- 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
- SCC and irradiation-assisted SCC
- primary water SCC
- wall thinning due to flow-accelerated corrosion
- changes in dimensions due to void swelling
- SCC and primary water SCC
- 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 (here for LRA Table 3.1.1, items 3.1.1-01 and 3.1.1-05 through 3.1.1-10) 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.

LRA Section 3.1.2.2.1 notes that the SRP-LR and the GALL Report incorrectly show LRA Table 3.1.1, item 1 as applicable only to BWR plants; however, GALL Report item IV.A2-20, pressure vessel support skirt and attachment welds, applies to PWR plants. LRA Section 3.1.2.2.1 states that the reactor vessel has no support skirt or attachment welds; however, the reactor vessel primary nozzle support pads are aligned to this item based on material, environment, aging effect, and program. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that HNP has no pressure vessel support skirt. On the basis that the AERM for GALL Report item IV.A2-20 applies to HNP's reactor vessel primary nozzle support pads, the staff agrees with the applicant's determination that the AMR result line in the GALL Report applies to the HNP's reactor vessel primary nozzle support pads.

LRA Table 3.1.1, items 3.1.1-02, 3.1.1-03, and 3.1.1-04, indicate that the AMR result lines are applicable to BWRs. The staff reviewed those AMR result lines in the SRP-LR and in the GALL Report and agrees with the applicant's determination that the lines do not apply to HNP, a PWR.

In reviewing LRA Tables 3.1.2-1 through 3.1.2-6, the staff noted that some AMRs credit the TLAA on thermal fatigue with the management of cracking due to thermal fatigue in the components. The corresponding AMR items in the GALL Report refer to this aging effect as cumulative fatigue damage and recommend that the TLAA on metal fatigue to manage it. The TLAA on metal fatigue is not acceptable for aging management in a component with a fatigue crack already initiated. During the audit, the staff asked the applicant to clarify (1) why the aging effect description (*i.e.*, cracking due to thermal fatigue) differs from that in the GALL Report, and (2) why the TLAA on metal fatigue can manage cracking due to thermal fatigue with fatigue-induced cracking already initiated.

In its response dated August 20, 2007, the applicant stated that:

1. The terminology used in the LRA is adopted from the EPRI Mechanical Tools. This methodology will identify this as a potential AERM under two conditions. First, if an explicit fatigue evaluation has been performed and is part of the

current licensing basis. Second, when using the temperature screening criterion for piping and equipment designed to ASME Section III, Class 2 and 3 and ANSI B31.1 that account for fatigue through use of the stress range reduction factor, f. At this point in the AMR process, the AERM is used as a placeholder to indicate that further evaluation is required.

2. A TLAA on metal fatigue is not considered capable of managing cracking due to metal fatigue. After the process described in 1 above, the AMR process ends and the TLAA evaluation begins. LRA Section 4.3 documents the resolution of those AMR lines where the potential aging effect of cracking has been postulated.

3. This methodology was used for the Brunswick license renewal project. The Safety Evaluation Report (page 3-185) addressed this issue as follows:

> The applicant's supplemental response to RAI 3.1.2.3.1.1-1, Part B, clarified that the phrase "cracking due to thermal fatigue," as defined in the applicable AMR line items for "Table 2" in LRA Sections 3.1, 3.2, 3.3, 3.4, and 3.5, corresponds to the definition "cumulative fatigue damage" in the applicant AMR line items for "Table 1" in LRA Sections 3.1, 3.2, 3.3, 3.4, and 3.5. The applicant changed the terminology because it recognized that 10 CFR 54.21(a) requires that aging effects be managed for the period of extended operation and because the term "cumulative fatigue damage" referred to a parameter that is used to assess the aging effect of cracking due to thermal fatigue and was not referring to the aging effect itself. Based on this assessment, the change in the terminology from "cumulative fatigue damage" in the "Table 1" to "cracking due to thermal fatigue" in the "Table 2" was done to satisfy the provision and criteria of 10 CFR 54.21(a). This meets the provisions in SRP-LR Sections 3.1, 3.2, 3.3, 3.4, and 3.5 for assessing cracking due to thermal fatigue/cumulative fatigue damage in ASME Code Class 1, 2, and 3 components and any applicable nonsafety-related components that are required to have thermal fatigue assessments for license renewal and, therefore, is acceptable. Refer to SER Section 4.3 for the staff's assessment of those plant components that are required to have thermal fatigue analyses for the LRA.

The staff finds the applicant's response acceptable. The staff has evaluated and accepted the methodology in the LRA tables for the cumulative fatigues aging effect.

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 criteria in SRP-LR Section 3.1.2.2.2:

(1) LRA Section 3.1.2.2.2.1, "PWR Steam Generator Shell and BWR Reactor Vessel Components Exposed to Treated Water and Steam," states that loss of material for BWR reactor vessel components applies to BWR plants only and that loss of material of once-through type steam generators, as in Babcock & Wilcox PWRs, is not present as

HNP steam generators are of a recirculating design supplied by Westinghouse as described in FSAR Section 5.4.2.

SRP-LR Section 3.1.2.2.2, item 1, 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 feedwater 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 staff reviewed GALL Report Table 1, SRP-LR items 11 and 12, and the comparable AMR result lines in the GALL Report (IV.A1-11 and IV.D2-8, respectively). The staff confirmed that the GALL Report and SRP-LR item 11 apply to BWRs and the GALL Report and SRP-LR for item 12 to once-through steam generators only. On the bases that HNP is not a BWR and has Westinghouse recirculating steam generators, the staff agrees with the applicant's determination that LRA Table 3.1.1, items 11 and 12 do not apply.

(2) LRA Section 3.1.2.2.2.2, "BWR Isolation Condenser Components Exposed to Reactor Coolant," states that loss of material of BWR isolation condenser components applies to BWR plants only.

SRP-LR Section 3.1.2.2.2, item 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 staff reviewed GALL Report Table 1, item 13 and the comparable AMR result lines in the GALL Report (IV.C1-6) and in the SRP-LR. The staff confirmed that GALL Report Table 1, item 13 applies only to BWRs. On the basis that HNP is not a BWR, the staff agrees with the applicant's determination that LRA Table 3.1.1, item 13 does not apply.

(3) LRA Section 3.1.2.2.2.3, "Reactor Vessel Shells, Heads, and Welds; Flanges, Nozzles; Penetrations; Pressure Housings; and Safe Ends," states that loss of material of BWR reactor vessel and RCPB components affects BWR plants only.

SRP-LR Section 3.1.2.2.2, item 3, 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 staff reviewed GALL Report Table 1, items 14 and 15, and the comparable AMR result lines in the GALL Report (IV.A1-8 and IV.C1-14, respectively) and in SRP-LR Table 3.1.1, items 14 and 15. The staff confirmed that the GALL Report and SRP-LR comparable line items apply only to BWRs. On the basis that HNP is not a BWR, the staff agrees with the applicant's determination that LRA Table 3.1.1, items 14 and 15 are not applicable to HNP.

(4) LRA Section 3.1.2.2.2.4, "PWR Steam Generator Shell and Transition Cone," states that loss of material due to general, pitting, and crevice corrosion could occur in the steel steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. The applicant manages the steam generator shell and transition cone with a combination of the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program for Class 2 components. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the loss of material aging effect. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, or IWD Program has been effective in managing aging effects in Class 1, 2, or 3 components and their attachments in light-water cooled power plants. The replacement steam generators are of the Westinghouse Delta 75 model as described in FSAR Section 5.4.2; therefore, the augmented inspection recommended by the GALL Report is not applicable.

SRP-LR Section 3.1.2.2.2, item 4, 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 existing program controls chemistry to mitigate corrosion and ISI to detect loss of material. The extent and schedule of the existing steam generator inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds; however, according to NRC Information Notice (IN) 90-04, the program may not be sufficient to detect pitting and crevice corrosion, if general and pitting corrosion of the shell is known to occur. The GALL Report recommends augmented inspection to manage this aging effect. Furthermore, the GALL Report Table 1, item 16, clarifies that this issue is limited to Westinghouse Model 44 and 51 steam generators with a high-stress region at the shell to transition cone weld.

The staff confirmed that the replacement steam generators are Westinghouse Delta 75 models. On the bases that the GALL Report clarifies that this issue is limited to Westinghouse Model 44 and 51 steam generators and that HNP replacement steam generators are Westinghouse Delta 75 models, the staff finds the applicant's statement that augmented inspection of the steam generators as described in SRP-LR Section 3.1.2.2.2.4 and the GALL Report does not apply. The LRA AMR result line states that the ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program and the Water Chemistry Program (without augmented inspection) will manage the aging effect of loss of material due to general, pitting, and crevice corrosion. The staff finds the AMR result consistent with the corresponding AMR result in the GALL Report and acceptable.

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 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 criteria in SRP-LR Section 3.1.2.2.3:

(1) LRA Section 3.1.2.2.3 states that certain aspects of the loss of fracture toughness due to neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3. Applicants must evaluate TLAAs (here for LRA Table 3.1.1, item 3.1.1-17) 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.

In reviewing LRA Table 3.1.1, item 17, the staff noted that GALL Report item IV.A2-16, which corresponds to GALL Report, Table 1, line 17, lists inlet and outlet safety injection nozzles made of steel with stainless steel cladding and that the GALL Report recommends a TLAA to be evaluated to manage loss of fracture toughness due to neutron irradiation embrittlement in reactor coolant and neutron flux environments for this item. During the audit the staff asked the applicant to explain why a comparable line item for inlet and outlet safety injection nozzles is not in LRA Table 3.1.2-1.

In its response dated August 20, 2007, the applicant stated that the reactor vessel has no safety-injection nozzles and the reactor vessel outlet nozzles were not components likely to receive fluences greater than 10^{17} n/cm^2 (E > 1.0 MeV); therefore, the reactor vessel outlet nozzles do not relate to GALL Report, Volume 2, item IV.A2-16 (R81). The applicant added that four other RCPB components outside the beltline region are likely to receive fluences greater than 1017 n/cm^2 (E > 1.0 MeV). These include (1) the circumferential weld between the upper and intermediate shells, (2) the upper shell, (3) the inlet nozzle welds, and (4) the inlet nozzle. Evaluation of these components were evaluated found none of these materials limiting in ART, charpy upper-shelf energy or reference temperature for pressurized thermal shock values. In Enclosure 2 of its letter dated August 20, 2007, the applicant added an AMR line-item for the reactor vessel primary nozzles internally exposed to treated water. Consistent with GALL Report Table 1, line item 17, the applicant stated that loss of fracture toughness due to neutron irradiation embrittlement will be evaluated by TLAA in accordance with 10 CFR Part 50 Appendix G and RG1.99.

In addition the applicant added the new Plant-Specific Note 126 to read:

> The HNP reactor vessel does not have safety injection nozzles. The reactor vessel outlet nozzles were not identified as components expected to receive fluences greater than 10^{17} n/cm2 (E > 1.0 MeV); therefore, the reactor vessel outlet nozzles do not apply to GALL Report, Volume 2, Item IV.A2-16 (R-81). Five other reactor coolant pressure boundary components outside the beltline region are expected to receive fluences greater than 10^{17} n/cm2, (E > 1.0 MeV). These components include: (1) the circumferential weld that is between the upper and intermediate shells, (2) the upper shell, (3) the inlet nozzle welds, (4) the inlet nozzle, and (5) upper shell longitudinal welds. These components were evaluated and none of these materials were determined to be limiting in adjusted reference temperature, C_VUSE or RTPTS values.

The staff finds the applicant's response acceptable because it clarified that either HNP does not have the comparable GALL Report components or the component does not receive fluences greater than 10^{17} n/cm^2. The applicant also committed to revise the LRA to add appropriate AMR lines for components outside the beltline region.

(2) LRA Section 3.1.2.2.3 addresses loss of fracture toughness due to neutron irradiation embrittlement by stating that such loss could occur in the reactor vessel beltline, shell, nozzle, and welds. A materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Evaluation of the materials outside of the traditional beltline region expected to receive fluence values greater than 10^{17} n/cm^2 determined that none of these materials was limiting. LRA Appendix B presents the Reactor Vessel Surveillance Program and the results of its evaluation for license renewal.

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 reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. 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.

The staff determined that the LRA correctly shows components subject to the aging effect of loss of fracture toughness due to neutron irradiation embrittlement and that AMR results in LRA Table 3.1.1, items 3.1.1-18 and 3.1.2-1 are consistent with GALL Report recommendations. The staff review of the applicant's Reactor Vessel Surveillance Program is documented in SER Section 3.0.3.2.13. On the basis of the staff's evaluation of the AMP and the staff's determination that the applicant's AMR results are consistent with the GALL Report, the staff finds the results acceptable. The staff finds this program consistent with GALL Report recommendations and adequate to manage the aging effect of loss of fracture toughness due to neutron irradiation embrittlement for carbon steel components clad with stainless steel exposed to reactor coolant.

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 criteria in SRP-LR Section 3.1.2.2.4:

(1) LRA Section 3.1.2.2.4.1, "BWR Vessel Leak Detection Lines," addresses SCC and IGSCC in BWR vessel leak detection lines by stating that this aging effect does not apply to HNP, a PWR plant.

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 staff reviewed GALL Report Table 1, SRP-LR line item 19, and comparable AMR result lines in the GALL Report. The staff confirmed that the GALL Report and the SRP-LR apply this line item only to BWRs. On the basis that HNP is not a BWR, the staff agrees with the applicant's determination that LRA Table 3.1.1, item 19, does not apply.

(2) LRA Section 3.1.2.2.4.2 addresses SCC and IGSCC in BWR isolation condenser components by stating that this aging effect does not apply to HNP, a PWR plant.

SRP-LR Section 3.1.2.2.4, item 2, states that cracking due to SCC and IGSCC may occur in stainless steel BWR isolation condenser components exposed to reactor coolant.

The staff reviewed GALL Report Table 1, SRP-LR Table 3.1.1, item 20, and the comparable AMR result lines in the GALL Report. The staff confirmed that the GALL Report and SRP-LR apply this line item, only to BWRs. On the basis that HNP is not a BWR, the staff agrees with the applicant's determination that LRA Table 3.1.1, item 20, does not apply.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.5 against SRP-LR Section 3.1.2.2.5 criteria.

LRA Section 3.1.2.2.5 states that growth of intergranular separations (underclad cracks) in the heat-affected zone under austenitic steel cladding is not an applicable aging effect because, as addressed in the initial (November 1983) HNP SER (NUREG-1038), the steel was melted according to fine-grain practice with low-heat input weld cladding processes.

SRP-LR Section 3.1.2.2.5 states that crack growth due to cyclic loading could occur in reactor vessel shell forgings clad with stainless steel by a high-heat-input welding process. Growth of intergranular separations (underclad cracks) in the heat-affected zone under austenitic stainless steel cladding is a TLAA to be evaluated for the period of extended operation for all SA 508-Cl 2 forgings with cladding deposited by high-heat-input welding.

The staff reviewed GALL Report Table 1, SRP-LR Table 3.1.1, item 21, the comparable AMR result lines in the GALL Report, and the cited document. The staff confirmed that the GALL Report and SRP-LR apply this line item only to cladding deposited by high-heat-input welding. On the basis that HNP uses a fine-grain practice with low-heat input cladding processes, the staff agrees with the applicant's determination that SRP-LR Table 3.1.1, item 21, does not apply.

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 by stating that loss of fracture toughness could occur in stainless steel and nickel alloy RVI exposed to reactor coolant and neutron flux. The FSAR Supplement, Section A.1.1, states commitments: (1) to participate in industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement results of the industry programs applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

SRP-LR Section 3.1.2.2.6 states that loss of fracture toughness due to neutron irradiation embrittlement and void swelling may occur in stainless steel and nickel alloy RVI components exposed to reactor coolant and neutron flux. The GALL Report recommends no further AMR if the applicant commits in the FSAR supplement (1) to participate in industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

In reviewing LRA Table 3.1.1, item 22, the staff notes the FSAR supplement commits to management of loss of fracture toughness due to neutron irradiation embrittlement and change in dimension due to void swelling; however, LRA Table 3.1.2-1 AMR line items for RVI components fabricated from stainless steel, nickel alloy, CASS corresponding to GALL Report Volume 1, line 22 do not provide for the commitment in the FSAR supplement.

During the audit, the staff asked the applicant to revise the LRA Table 3.1.2-1 AMR line items to include the commitment in the FSAR supplement.

In its response dated August 20, 2007, the applicant stated that the LRA currently states a commitment (1) to participate in industry (RVI aging programs, (2) to implement applicable results, and (3) to submit for NRC approval at least 24 months before the period of extended operation an RVI inspection plan based on industry recommendation. Review of the Table 2 items corresponding to Table 1 items 3.1.1-22, 3.1.1-27, 3.1.1-30, 3.1.1-33, and 3.1.1-37 demonstrates this commitment. For example, Table 1, item 3.1.1-22 on page 3.1-23 states that, "The HNP commitment is described in the FSAR supplement. Further evaluation is documented in Subsection 3.1.2.2.6." LRA Section 3.1.2.2.6 and page 5 of LRA Appendix A (FSAR supplement) also refer to similar statements of this commitment. Further, the applicant's response stated that the commitment in the Table 1 item (Table 3.1.1) applies to all corresponding Table 2 AMR lines in LRA Section 3.1. The applicant clearly confirmed that the commitment in LRA Section 3.1.2.2.6 and FSAR Section A.1.1 applies to AMPs that manage loss of fracture toughness due to neutron irradiation embrittlement and change in dimension due to void swelling for all RVI made of stainless steel, nickel alloy, and CASS and exposed to treated water corresponding to GALL Report Table 1, item 22.

Based on these findings, for those line items that apply to LRA Section 3.1.2.2.6 the staff determines that the LRA meets SRP-LR Section 3.1.2.2.6 criteria and is consistent with the GALL Report. 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.7 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.7 against the criteria in SRP-LR Section 3.1.2.2.7:

(1) LRA Section 3.1.2.2.7.1 addresses SCC in PWR vessel leak detection piping and bottom-mounted instrument guide tubes by stating that SCC could occur in stainless steel PWR reactor vessel flange leak detection lines. Cracking from SCC of these lines is managed by a combination of the Water Chemistry Program and the One-Time Inspection Program. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the cracking aging effect. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain intended functions of affected components during the period of extended operation.

LRA Section 3.1.2.2.7 further clarifies that the flux thimble guide tubes are aligned to item 3.1.1-30 (GALL Report item IV.B2-12) for SCC.

SRP-LR Section 3.1.2.2.7 states that SCC may occur in the PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The GALL Report recommends that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed.

LRA Table 3.1.1, item 23, under the discussion column, states that the flux thimble guide tubes are aligned to GALL Report Table 1, item 30, which corresponds to GALL Report item IV.B2-12, for SCC. The staff noted that GALL Report item IV.A2-1 corresponds to the GALL Report Table 1, item 23 for SCC for stainless steel bottom-mounted guide tubes in reactor coolant environments; however, the LRA does not address GALL Report item IV.A2-1 in Table 3.1.2-1 AMR line items.

During the audit, the staff requested from the applicant a basis for using GALL Report item IV.B-12 instead item IV.A2-1 for the flux thimble guide tubes line item.

In its response dated August 20, 2007, the applicant clarified that because all bottom-mounted instrumentation guide tubes are flux thimble guide tubes, they are aligned to the GALL Report for the bottom-mounted instrumentation (IV.B2.12). The staff finds this response acceptable because it clarified that the LRA appropriately aligns the flux thimble guide tubes with the bottom-mounted instrumentation line items.

LRA Table 3.1.2-1 on page 3.1-41 credits the Water Chemistry and One-Time Inspection programs for managing SCC for stainless steel vessel flange leak detection lines. GALL

Report Table 1, item 23 recommends a plant-specific program which should be further evaluated by the staff.

During the audit, the staff asked the applicant to describe any plant-specific or industry operating experience with stainless steel SS vessel flange leak detection line failure and explain how a one-time inspection detects SCC for this item. Further, the staff requested from the applicant a basis for using one-time inspection and water chemistry to manage SCC for the vessel flange leak detection line.

In its response dated August 20, 2007, the applicant stated that plant-specific and industry operating experience since January 1, 2005, shows no stainless steel vessel flange leak detection line failures. The applicant also clarified that the One-Time Inspection Program detects SCC for this item by enhanced visual (VT-1 or equivalent) or volumetric (radiographic test or UT) inspection or both. Unacceptable components/structures are processed by the corporate Corrective Action Program, which complies with 10 CFR Part 50 Appendix B. The applicant clarified that the vessel flange leak detection line is not ASME Code Class 1; therefore, it is not in the One-Time Inspection of Small Bore Class 1 RCS Piping Program. Although these lines are typically dry, any leaks at the vessel flange would expose the components internally to primary water; thus, the Water Chemistry Program is appropriate to manage SCC. As there is no operating experience with cracking in these lines, the One-Time Inspection Program is appropriate to confirm that the aging effect has not occurred.

The staff finds the applicant's response to its question acceptable as a basis for use of the Water Chemistry and One-Time Inspection Programs to manage SCC for components in LRA Table 3.1.1-2.

(2) LRA Section 3.1.2.2.7.2 addresses SCC in CASS) RCS components, stating that SCC could occur in Class 1 PWR CASS piping exposed to reactor coolant. SCC of the CASS reactor coolant system components is managed by a combination of the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The Water Chemistry Program monitors and controls water chemistry using procedures and processes to prevent or mitigate the cracking aging effect. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program has been effective in managing aging effects in Class 1, 2, or 3 components and their attachments in light-water cooled power plants.

SRP-LR Section 3.1.2.2.7, item 2, states that SCC may occur in Class 1 PWR CASS) reactor coolant system piping, piping components, and piping elements exposed to reactor coolant. The existing program controls water chemistry to mitigate SCC; however SCC may occur in CASS components that do not meet the NUREG-0313 guidelines with regard to ferrite and carbon content. The GALL Report recommends further evaluation of a plant-specific program for these components to ensure this aging effect is adequately managed.

LRA Table 3.1.2-3 on page 3.1-109 lists CASS piping, piping components, and piping elements in treated water environments. The LRA credits the ASME Section XI Inservice

Inspection, Subsections IWB, IWC, and IWD Program and the Water Chemistry Program to manage SCC. The LRA shows consistency with GALL Report item IV.C2-3 and GALL Report Table 1, item 24. The LRA uses Notes E, 109, and 112 for these line items. Note E indicates that the program is different from the GALL Report for this component, material, environment, and aging effect combination. Note 109 states that the elbows in the primary loop piping are fabricated from SA351 CF8A material and Note 112 states that "cracking due to SCC could occur in PWR CASS reactor coolant system piping and fittings." For PWRs, the GALL Report recommends further evaluation of piping that does not meet reactor water chemistry guidelines of TR-105714, "PWR Primary Water Chemistry Guidelines, Revision 3," November 1995, or later. HNP use of the EPRI Water Chemistry Guidelines minimizes the potential for SCC in accordance with the GALL Report and no further evaluation of a plant-specific AMP is required. In addition, HNP uses the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to verify the effectiveness of the Water Chemistry Program in preventing cracking of CASS components.

GALL Report Table 1, item 24 recommends the Water Chemistry Program and a plant-specific program for CASS components that do not meet NUREG-0313 guidelines. GALL Report item IV.C2-03, which corresponds to GALL Report Table 1, item 24 and is addressed in the LRA, states that "monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Revision 3 or later) minimize the potential of SCC, and material selection according to NUREG-0313, Revision 2 guidelines of 0.035 percent C and 7.5 percent ferrite reduces susceptibility to SCC." The GALL Report recommends for CASS components that meet neither guideline evaluation of any plant-specific AMP. The GALL Report recommends further evaluation of any plant-specific AMP used.

During the audit, staff reviewed the applicant's license renewal AMR basis document for RCPB systems and other supporting documents. The staff verified that piping, piping components, and piping elements exposed to treated water are fabricated from CASS material with less than 0.035 percent carbon and from a minimum of 7.5 percent ferrite. Based on its review and audit, the staff agreed with the applicant that HNP meets the guidelines of EPRI TR-105714 and NUREG-0313 and no further evaluation of a plant-specific AMP is required because HNP uses the Water Chemistry and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Programs to manage cracking of CASS components. The staff's evaluation of the applicant's Water Chemistry Program is documented in SER Section 3.0.3.1.1, the staff's evaluation of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program in SER Section 3.0.3.2.1. On the basis of its review of these programs, the staff finds that the applicant's Water Chemistry Program and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program are adequate to mitigate and manage SCC for CASS components in treated water environments.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.7 criteria. For those line items that apply to LRA Section 3.1.2.2.7, 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).

3.1.2.2.8 Cracking Due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.8 against the criteria in SRP-LR Section 3.1.2.2.8:

(1) LRA Section 3.1.2.2.8.1, "BWR Jet Pump Sensing Lines," states that cracking of BWR jet pump-sensing lines applies to BWR plants only.

SRP-LR Section 3.1.2.2.8, item 1, states that cracking due to cyclic loading may occur in the stainless steel BWR jet pump sensing lines.

The staff reviewed GALL Report Table 1, SRP-LR item 25, and the comparable AMR result lines in the GALL Report. The staff confirmed that the GALL Report and SRP-LR apply, for this line item, only to BWRs. On the basis that HNP is not a BWR, the staff agrees with the applicant's determination that SRP-LR Table 3.1.1, item 25, does not apply.

(2) LRA Section 3.1.2.2.8.2, "BWR Isolation Condenser Components," states that cracking of isolation condenser components applies to BWR plants only.

SRP-LR Section 3.1.2,2.8, item 2, states that cracking due to cyclic loading may occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant.

The staff reviewed GALL Report Table 1, SRP-LR item 26, and the comparable AMR result lines in the GALL Report. The staff confirmed that the GALL Report and SRP-LR apply, for this line item, only to BWRs. On the basis that HNP is not a BWR, the staff agrees with the applicant's determination that SRP-LR Table 3.1.1, item 26, does not apply.

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 by stating that such aging affect could occur in stainless steel and nickel alloy PWR RVI components exposed to reactor coolant. The FSAR supplement states commitments: (1) to participate in industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of industry programs applicable to the reactor internals, and (3) upon completion of these programs but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

SRP-LR Section 3.1.2.2.9 states that loss of preload due to stress relaxation may occur in stainless steel and nickel alloy PWR RVI screws, bolts, tie rods, and hold-down springs exposed to reactor coolant. The GALL Report recommends no further AMR if the applicant commits in the FSAR supplement (1) to participate in the industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

In reviewing LRA Table 3.1.1, item 27, the staff noted that the FSAR supplement commits to managing loss of preload due to stress relaxation; however, LRA Table 3.1.2-1 AMR line items for stainless steel and nickel alloy PWR RVI components exposed to reactor coolant corresponding to GALL Report Volume 1, line 27 include no provision for the FSAR supplement commitment.

During the audit, the staff asked the applicant to revise the LRA Table 3.1.2-1 AMR line items to include the FSAR supplement commitment.

In its letter dated August 20, 2007, the applicant stated that the LRA states a commitment (1) to participate in industry RVI aging programs, (2) to implement applicable results, and (3) to submit for NRC approval at least 24 months before the period of extended operation an RVI inspection plan based on industry recommendation. Reviews of Table 2 items corresponding to Table 1 items 3.1.1-22, 3.1.1-27, 3.1.1-30, 3.1.1-33, and 3.1.1-37 demonstrates this commitment. During the audit, the applicant pointed out that Table 1, item 3.1.1-27 states that the commitment is described in the FSAR supplement with further evaluation is documented in LRA Section 3.1.2.2.9. Further, the applicant's response stated that the commitment described in Table 1, item 3.1.1-27 applies to all corresponding Table 2 AMR lines in LRA Section 3.1.

The staff finds the applicant's response acceptable on the basis that HNP confirmed that the commitment in LRA Section 3.1.2.2.9 and FSAR Section A.1.1 applies to AMPs that manage loss of preload due to stress relaxation for stainless steel and nickel alloy PWR RVI exposed to treated water corresponding to GALL Report Table 1, item 27.

Based on these findings, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.9 criteria. For those line items that apply to LRA Section 3.1.2.2.9, 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).

3.1.2.2.10 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 by stating such loss could occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. The One-Time Inspection Program manages loss of material due to erosion of the steam generator feedwater impingement plate components. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

SRP-LR Section 3.1.2.2.10 states that loss of material due to erosion may occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

In reviewing LRA Table 3.1.1, item 3.1.1-28 that corresponds to this section, the staff noted that LRA Table 3.1.2-6 shows loss of material due to erosion as an aging effect for external surfaces of "steam generator feedwater impingement plate and support" fabricated from carbon or low-alloy steel in treated water. The LRA uses Note E, which indicates consistency with GALL Report Table 1, item 28 and GALL Report item IV.D1-13 for component, material, environment, and aging effect, but the LRA does not credit the GALL Report's AMP. GALL Report item IV.D1-13 recommends plant-specific AMP that needs further evaluation. The LRA credits the One-Time Inspection Program for managing loss of material due to erosion.

During the audit, the staff requested from the applicant a basis for the One-Time Inspection Program for this line item and an explanation of how the One-Time Inspection Program manages loss of material due to erosion for steam generator feedwater impingement plates and supports exposed to secondary feedwater.

In its response dated August 20, 2007, the applicant stated that IN 97-88, "Experiences During Recent Steam Generator Inspections," dated December 16, 1997, states that in May 1997 "the licensee for the Shearon Harris Nuclear Power Plant found that four perforated, carbon steel ribs in a steam generator had been extensively damaged. The ribs are welded to the feedwater impingement plate which shields the steam generator tubes from direct impact of the feedwater flow. The licensee concluded that the high flow velocities of the feedwater eroded the ligaments between the perforations on the ribs."

The applicant added that the steam generators have been replaced and the Westinghouse replacement Model Delta 75 steam generators have no feedwater impingement plates as with preheater model steam generators installed in the old model D4s. Further, the applicant explained that the "impingement plates" in the LRA are ten .25-inch thick carbon steel (ASME-SA-285, Gr. C) baffles located between the primary separator outer riser barrels to prevent direct impingement of feedwater onto the upper shell. There has been no operating experience showing erosion of the baffles or supports. The One-Time Inspection Program inspections should be scheduled no earlier than 10 years prior to the period of extended operation. HNP will have at least 30 years of use before inspections under this program begin, sufficient time for aging effects, if any, to be manifest.

The staff finds the applicant's response acceptable on the basis that no operating experience shows erosion of baffles in the replaced steam generators. In addition, the One-Time Inspection Program inspections will be adequate to detect any loss of material due erosion.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.10 criteria. For those line items that apply to LRA Section 3.1.2.2.10, 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).

3.1.2.2.11 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 states that cracking of BWR steam dryer components applies to BWR plants only. 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 staff reviewed GALL Report Table 1, SRP-LR Table 3.1.1, item 29, and the comparable AMR result lines in the GALL Report. The staff confirmed that the GALL Report and SRP-LR apply, for this line item, only to BWRs. On the basis that HNP is not a BWR, the staff agrees with the applicant's determination that SRP-LR Table 3.1.1, item 29, does not apply.

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 SCC and irradiation-assisted stress corrosion cracking (IASCC) by stating that either SCC and IASCC could occur in PWR stainless steel reactor internals exposed to reactor coolant. The Water Chemistry Program manages RVI components exposed to reactor coolant by monitoring and controlling of water chemistry using site procedures and processes to prevent or mitigate the cracking aging effect. In addition, the FSAR supplement states commitments: (1) to participate in the industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

SRP-LR Section 3.1.2.2.12 states that SCC and IASCC may occur in PWR stainless steel reactor internals exposed to reactor coolant. The existing program controls water chemistry to mitigate these aging effects. The GALL Report recommends no further AMR if the applicant commits in the FSAR supplement (1) to participate in the industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

GALL Report Table 1, item 30, and GALL Report, Volume 2, Section IV components corresponding to GALL Report Table 1, item 30 and addressed in the LRA for this Table 1 item recommend the Water Chemistry Program and a commitment in the FSAR supplement, as stated in SRP-LR Section 3.1.2.2.12, to manage SCC and IASCC for stainless steel and CASS RVI components exposed to reactor coolant environments.

LRA Table 3.1.1, item 30, and Table 3.1.2-1 AMR line items that correspond to GALL Report Table 1, item 30, credit water chemistry for managing cracking for these AMRs. The staff's evaluation of the applicant's Water Chemistry Program is documented in SER Section 3.0.3.1.1. On the basis of its review of this program, the staff finds the applicant's Water Chemistry Program consistent with the GALL Report and adequate to mitigate SCC for stainless CASS RVI components in treated water environments.

In reviewing LRA Table 3.1.1, item 30, the staff noted that the FSAR supplement commits to managing cracking due to SCC and IASCC; however, LRA Table 3.1.2-1 AMR line items for stainless steel and CASS RVI components exposed to reactor coolant corresponding to GALL Report Volume 1, line 30, do not provide for the commitment in the FSAR supplement.

During the audit, the staff asked the applicant to revise the LRA Table 3.1.2-1 AMR line items to include the commitment in the FSAR supplement.

In its response dated August 20, 2007, the applicant stated that the LRA states a commitment (1) to participate in industry RVI aging programs, (2) to implement applicable results, and (3) to submit for NRC approval at least 24 months before the period of extended operation an RVI inspection plan based on industry recommendation. Review of Table 2 items that correspond to Table 1 items 3.1.1-22, 3.1.1-27, 3.1.1-30, 3.1.1-33, and 3.1.1-37 demonstrates this commitment. The applicant also pointed out that Table 1, item 3.1.1-30, states that the commitment is described in the FSAR supplement with further evaluation in Section 3.1.2.2.12. Further, the applicant, in its response, clarified that the commitment in Table 1, item 3.1.1-30 applies to all corresponding Table 2 AMR lines in LRA Section 3.1.

The staff finds the applicant's response acceptable on the basis that it confirmed that the commitment in LRA Section 3.1.2.2.12 and FSAR Section A.1.1 applies to AMPs that manage cracking due to SCC and IASCC for stainless steel and CASS RVI exposed to treated water corresponding to GALL Report Table 1, item 30.

Based on these findings, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.12 criteria. For those line items that apply to LRA Section 3.1.2.2.12, 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).

3.1.2.2.13 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 stress corrosion cracking (PWSCC) by stating that such PWSCC could occur in PWR components made with nickel alloy and steel with nickel alloy cladding exposed to reactor coolant. Cracking due to SCC (including PWSCC) of nickel alloy and low alloy steel with nickel alloy cladding, including reactor coolant pressure boundary components and penetrations inside the reactor coolant system (*e.g.*, pressurizer heater sheaths and sleeves, nozzles, and other internal components) is managed by a combination of the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the cracking aging effect. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program has been effective in managing aging effects in Class 1, 2, or 3 components and their attachments in light-water cooled power plants. In addition, the FSAR supplement states a commitment to comply with applicable NRC Orders and to implement applicable (1) bulletins and generic letters, and (2) staff-accepted industry guidelines.

SRP-LR Section 3.1.2.2.13 states that PWSCC may occur in PWR components made of nickel alloy and steel with nickel alloy cladding, including reactor coolant pressure boundary components and penetrations inside the reactor coolant system such as pressurizer heater sheathes and sleeves, nozzles, and other internal components. Except for reactor vessel upper head nozzles and penetrations, the GALL Report recommends ASME Code Section XI ISI (for Class 1 components) and control of water chemistry. For nickel alloy components, no further AMR is necessary if the applicant complies with applicable NRC orders and commits in the FSAR supplement to implement applicable (1) bulletins and generic letters, and (2) staff-accepted industry guidelines.

In reviewing the GALL Report Table 1, item 31, which corresponds to SRP Section 3.1.2.2.13, the staff noted that LRA tables do not include the AMR line items for the following GALL Report, Volume 2 components that correspond to GALL Report Table 1, item 31: IV.D1-4 (steam generator instrument penetrations and primary side nozzles, safe ends, and welds), IV.C2-21 (pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges), and IV.C2-13 (RCS piping, piping components, and elements) made of nickel alloy or steel with nickel alloy cladding and exposed to reactor coolant. During the audit, the staff asked the applicant to explain why comparable line items for these components with their MEAPs are not in the LRA tables.

In its response dated August 20, 2007, the applicant stated that the GALL Report items do not apply for the following reasons: (1) IV.D1-4: the HNP steam generators have no nickel-based alloy instrument penetration, (2) IV.C2-21: the HNP pressurizer has no nickel alloy instrumentation, penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges, and (3) IV.C2-13: except for RCS components aligned to the GALL Report, there is no nickel alloy or steel with nickel alloy cladding that would align to this GALL Report item.

During the audit, the staff reviewed the applicant's license renewal AMR basis document for RVI and other supporting documents and determined that the applicant appropriately indicated components that align to GALL Report Table 1, item 31; therefore, the staff finds the applicant's response acceptable.

LRA Tables 3.1.2-1 and 3.1.2-5 credit the Water Chemistry and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Programs to manage PWSCC of nickel-based alloy components. The staff's evaluation of the applicant's Water Chemistry Program is documented in SER Section 3.0.3.1.1, the staff's evaluation of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program in SER Section 3.0.3.2.1.

GALL Report, Revision 1, Volumes 1and 2, include AMR items to manage various forms of SCC in nickel alloy and stainless steel RCPB components. For aging management, the GALL Report recommends that the FSAR supplement include a commitment to implement: (1) NRC orders, bulletins, and GLs on nickel alloy components and (2) staff-accepted industry guidelines. Based on its review of the AMR line items for LRA Table 3.1.1, item 31, the staff determined either that LRA tables lacked AMR items to manage SCC in some nickel-alloy RCPB components exposed to reactor coolant or that the existing AMR items did not provide for the commitment in the FSAR supplement.

During the audit, the staff asked the applicant to indicate all RCPB nickel-alloy components and weld locations exposed to reactor coolant and to clarify whether the LRA includes AMRs on management of SCC or any of its forms (*e.g.*, PWSCC) in the components. The staff asked the applicant to revise the LRA to include any omitted AMR entries on management of SCC (or its forms) in specific nickel alloy components or welds. In addition, the staff asked the applicant to revise all AMRs on SCC of nickel-alloy components or welds to include the commitment for nickel-alloy AMR items in the GALL Report.

In its response dated August 20, 2007, the applicant stated that the nickel alloy components/welds are as follow: pressure safety and relief nozzle weld, surge nozzle safe end weld, spray nozzle safe end, CRDM nozzle head, CRDM nozzle weld, head vent, bottom head instrument penetration, core support pads, hot leg-to-reactor vessel weld, and cold leg-to-reactor vessel weld. The applicant stated that revised LRA tables will include pressurizer spray nozzle safe end, pressurizer relief safe end, and pressurizer safety nozzle safe end. In addition, the applicant's response stated that the LRA states commitments to (1) NRC orders, bulletins, and GLs on nickel alloys and (2) staff-accepted industry guidelines. Review of the Table 2 items that correspond to the following Table 1, item 3.1.1-31 demonstrates these commitments. For example, Table 1, item 3.1.1-31 states: "Consistent with NUREG-1801 [GALL Report] with exception. The aging effect is managed by a combination of the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The HNP commitment is described in the FSAR supplement." Also, LRA Section 3.1.2.2.13 states that, "In addition, HNP provides in the FSAR supplement a commitment to comply with applicable NRC Orders and to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines." A similar statement is in FSAR Supplement Section A.1.2. The applicant clarified that the commitment in the Table 1 item (Table 3.1.1) applies to all corresponding Table 2 AMR lines in LRA Section 3.1.

The staff finds the applicant's response acceptable on the basis that it confirmed that the commitment in LRA Section 3.1.2.2.13 and FSAR Section A.1.1 applies to AMPs that manage PWSCC for nickel-based alloy components internally exposed to treated water corresponding to GALL Report Table 1, item 31.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.13 criteria. For those line items that apply to LRA Section 3.1.2.2.13, 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).

3.1.2.2.14 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 flow-accelerated corrosion by stating that such wall thinning could occur in steam generator feedwater inlet rings and supports. The One-Time Inspection Program manages loss of material due to flow-accelerated corrosion of the steam generator feedwater distribution ring and related components. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

SRP-LR Section 3.1.2.2.14 states that wall thinning due to flow-accelerated corrosion may occur in steel feedwater inlet rings and supports. The GALL Report references IN 91-19, "Steam Generator Feedwater Distribution Piping Damage," for evidence of flow-accelerated corrosion in steam generators and recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting wall thinning due to flow-accelerated corrosion.

LRA Table 3.1.2-6 shows loss of material due to FAC as an aging effect for external surfaces of "steam generator feedwater impingement plate and support" fabricated from carbon or low-alloy steel in treated water. The LRA uses Note E, which indicates consistency with GALL Report Table 1, item 32 and GALL Report item IV.D1-26 for component, material, environment, and aging effect, but the LRA does not credit the GALL Report AMP. GALL Report item IV.D1-26 indicates wall thinning due to FAC and recommends a plant-specific AMP. During the audit, the staff noted that the applicant considers the aging effects "wall thinning" and "loss of material" equivalent as to FAC. The staff finds this approach acceptable because loss of material due to FAC is comparable to the wall-thinning aging effect.

The staff reviewed IN 91-19 and noted that it describes a problem with combustion engineering steam generator designs. The staff also noted that the applicant credits the Water Chemistry and One-Time Inspection Programs for managing loss of material due to FAC for steam generator feedwater impingement plates and supports during the period of extended operation for the Westinghouse-designed steam generators.

During the audit and review, the staff asked the applicant to clarify how the One-Time Inspection Program manages loss of material due to FAC for steam generator feedwater impingement plates and supports.

In its response dated December 11, 2007, the applicant stated that HNP inspected the interior of the feedwater inlet ring of the "B" and "C" steam generators during RFO 13 in 2006. This inspection employed remote visual equipment with recording capabilities for a basis for comparison with the results of future inspections. The applicant added that alternative techniques to remote visual may inspect the feedwater distribution ring and related components for loss of material due to FAC depending on industry operating experience with the Westinghouse Delta 75 steam generators and development of additional inspection techniques. The staff finds the applicant's approach acceptable because visual inspection records provide a basis for evaluation of the future one-time inspection.

The staff's evaluation of the applicant's Water Chemistry Program is documented in SER Section 3.0.3.1.1, the staff's evaluation of the applicant's One-Time Inspection Program in SER Section 3.0.3.2.5. Based on its evaluations of these programs, the staff finds that the applicant's Water Chemistry Program mitigates and its One-Time Inspection Program detects the aging effect of loss of material due to FAC during the period of extended operation. The staff finds that these programs are consistent with GALL Report recommendations and adequate to manage the aging effect of loss of material due FAC for the steam generator feedwater impingement plate and support.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.14 criteria. For those line items that apply to LRA Section 3.1.2.2.14, 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).

3.1.2.2.15 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 dimensions due to void swelling by stating that such changes in dimensions could occur in stainless steel and nickel alloy PWR RVI components exposed to reactor coolant. The FSAR supplement states commitments: (1) to participate in the industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

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 GALL Report recommends no further AMR if the applicant commits in the FSAR supplement (1) to participate in the industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

In reviewing GALL Report Table 1, item 33, which corresponds to SRP Section 3.1.2.2.15, the staff noted that LRA tables do not include the AMR line items for the following GALL Report, Volume 2 components that correspond to GALL Report Table 1, item 33: IV.B2-7 (core barrel, core barrel upper flange, core barrel outlet nozzles, and thermal shield), IV.B2-1 (baffle/former plates), IV.B2-4 (baffle/former bolts), IV.B2-15 (lower internal assembly fuel alignment pins, lower support plate column bolts, and clevis insert bolts), and IV.B2-11(instrumentation support structures flux thimble guide tubes) made of nickel alloy or steel with nickel alloy cladding and exposed to reactor coolant.

During the audit, the staff asked the applicant to explain why comparable line items for these components with their MEAPs are not in the LRA tables. The applicant responded that GALL Report items IV.B2-7, IV.B2-1, IV.B2-4, and IV.B2-15 apply to components within a reactor coolant environment. The HNP AMR considers these components as in a reactor coolant and high-neutron flux environment which would align to GALL Report items IV.B2-9, IV.B2-3, IV.B2-6, and IV.B2-17. The applicant explained that these GALL Report items correspond to GALL Report Table 1, line 22 which includes both loss of fracture toughness due to neutron irradiation embrittlement and changes in dimensions due to void swelling. Further, the applicant clarified that GALL Report item IV.B2-11 applies to flux thimble guide tubes outside the reactor vessel and not subject to radiation levels above the threshold for changes in dimensions due to void swelling; therefore, the applicant determined that the flux thimble tubes are not subject to such changes in dimensions and that GALL Report item IV.B2-11 does not apply.

During the audit, the staff reviewed the applicant's supporting documents and determined that the applicant appropriately indicated components that align to GALL Report Table 1, item 33; therefore, the staff finds the applicant's response acceptable.

In reviewing LRA Table 3.1.1, item 33, the staff noted that the FSAR supplement commits to managing change in dimensions due to void swelling; however, LRA Table 3.1.2-1 AMR line items for stainless steel and nickel alloy PWR RVI components exposed to reactor coolant corresponding to GALL Report Table 1, line 33, do not provide for the commitment in the FSAR supplement.

During the audit, the staff asked the applicant to revise LRA Table 3.1.2-1 AMR line items to include the commitment in the FSAR supplement.

In its response dated August 20, 2007, the applicant stated that the LRA states a commitment (1) to participate in industry RVI aging programs, (2) to implement applicable results, and (3) to submit for NRC approval at least 24 months before the period of extended operation an RVI inspection plan based on industry recommendation. Review of Table 2 items corresponding to Table 1 items 3.1.1-22, 3.1.1-27, 3.1.1-30, 3.1.1-33, and 3.1.1-37 demonstrates this commitment. During the audit, the applicant pointed out that Table 1, item 3.1.1-33, states that the HNP commitment is described in the FSAR supplement with further evaluation in Section 3.1.2.2.15. Further the applicant, in its response, clarified that the commitment in Table 1, item 3.1.1-33 applies to all corresponding Table 2 AMR lines in LRA Section 3.1. The staff finds the applicant's response acceptable because it confirmed that the commitment in LRA Section 3.1.2.2.15 and FSAR Section A.1.1 applies to AMPs that manage change in dimensions due to void swelling for stainless steel and nickel alloy PWR RVI components exposed to reactor coolant corresponding to GALL Report Table 1, item 33.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.15 criteria. For those line items that apply to LRA Section 3.1.2.2.15, 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).

3.1.2.2.16 Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.16 against the criteria in SRP-LR Section 3.1.2.2.16:

(1) LRA Section 3.1.2.2.16 addresses SCC and PWSCC in control rod drive head penetration pressure housings by stating that such cracking is managed by the Water Chemistry Program in combination with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the cracking aging effect. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program has been effective in managing aging effects in Class 1, 2, or 3 components and their attachments in light-water cooled power plants. Only stainless steel or stain less steel-clad components are present in this item; therefore, no commitment as to nickel alloys is necessary.

SRP-LR Section 3.1.2.2.16 states that 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 GALL Report recommends ASME Code Section XI ISI and control of water chemistry to manage this aging effect and recommends no further AMR for PWSCC of nickel alloy if the applicant complies with applicable NRC orders and commits in the FSAR supplement to implement applicable (1) bulletins and generic letters, and (2) staff-accepted industry guidelines.

The staff noted that in SRP-LR Table 3.1-1 there are two lines, items 34 (for control rod drive head penetration) and 35 (for steam generator), that refer to SRP-LR Section 3.1.2.2.16.1 and that these lines are the same as GALL Report, Volume 1, Table 1, items 34 and 35. The staff noted that all AMR results in LRA Table 3.1.2-1 referring to LRA Table 3.1.1, item 34, are for components constructed of stainless steel or alloy steel with stainless steel cladding. The staff reviewed details of the applicant's AMR evaluation and found no omissions of construction materials for these components. The LRA states that for these components the aging effect of SCC or PWSCC will be managed by the Water Chemistry Program in combination with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff's evaluations of these AMPs are in SER Sections 3.0.3.2.1 and 3.0.3.1.1, respectively. On the basis of the staff's evaluation of the specified AMPs and because all components in the AMR result line are made of stainless steel, the staff finds the applicant's use of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and the Water Chemistry Program acceptable and the AMR result consistent with GALL Report recommendations.

LRA Table 3.1.1, item 35, states that steam generators are recirculating and not once-through; therefore, this aging effect is not present and no commitment is required. The staff noted that GALL Report, Volume 1, Table 1, item 35, refers only to GALL Report item IV.D2-4, which is for nonrecirculating steam generators, and that comparable AMR results for recirculating steam generator components are in the GALL Report, Volume 1, Table 1, items 81, 82 and 84. On the basis that the SRP-LR subsection applies to once-through steam generators and HNP has recirculating steam generators, the staff agreed with the applicant that no further evaluation is required.

(2) LRA Section 3.1.2.2.16 addresses SCC and PWSCC in the pressurizer spray head by stating that SCC could occur on stainless steel pressurizer spray heads and PWSCC could affect nickel alloy pressurizer spray heads. The pressurizer spray head is fabricated from CASS. A combination of Water Chemistry Program and the One-Time Inspection Program manages SCC of the pressurizer spray head. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the cracking aging effect. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation. No applicant commitment as to spray head inspection is required because the pressurizer spray head is fabricated from CASS.

SRP-LR Section 3.1.2.2.16 states that SCC may occur on stainless steel pressurizer spray heads. Cracking due to PWSCC may occur on nickel-alloy pressurizer spray heads. The existing program controls water chemistry to mitigate this aging effect. The GALL Report recommends one-time inspection to confirm that cracking has not occurred. For nickel alloy welded spray heads, the GALL Report recommends no further AMR if the applicant complies with applicable NRC orders and commits in the FSAR supplement to implement applicable (1) bulletins and generic letters, and (2) staff-accepted industry guidelines.

The staff noted that all AMR results in LRA Table 3.1.2-5 referring to LRA Table 3.1.1, item 36, are for components in which the material of construction is CASS or stainless steel and that the discussion column of LRA Table 3.1.1, item 36, states that no licensee commitment is required as the pressurizer spray head at HNP is fabricated from CASS. The staff reviewed details of the applicant's AMR results and found no omissions of construction materials for these components. LRA Section 3.1.2.2.16 states that for these components the aging effect of SCC or PWSCC will be managed by the Water Chemistry Program and by One-Time Inspection Program. The staff's evaluations of these AMPs are in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively. On the basis of the staff's evaluation of the specified AMPS and because all components included in the AMR results line are made of stainless steel, the staff finds the applicant's use of the Water Chemistry Program and by the One-Time Inspection Program acceptable and the AMR result consistent with GALL Report recommendations.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.16 criteria. For those line items that apply to LRA Section 3.1.2.2.16, 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).

3.1.2.2.17 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 SCC, primary water stress corrosion cracking, and irradiation-assisted stress corrosion cracking. The applicant stated that SCC, PWSCC, or IASCC by stating that such cracking could occur in stainless steel and nickel alloy PWR RVI components. The Water Chemistry Program manages SCC of the PWR stainless steel and nickel alloy RVI components and monitors and controls water chemistry using site procedures and processes to prevent or mitigate the cracking aging effect. In addition, The FSAR Supplement states commitments: (1) to participate in the industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

SRP-LR Section 3.1.2.2.17 states that SCC, PWSCC, and IASCC may occur in PWR stainless steel and nickel alloy RVI components. The existing program controls water chemistry to mitigate these aging effects; however, the existing program should be augmented to manage these aging effects for RVI components. The GALL Report recommends no further AMR if the applicant commits in the FSAR supplement (1) to participate in the industry programs for investigating and managing aging effects on reactor internals, (2) to evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, to submit an inspection plan for reactor internals to the staff for review and approval.

GALL Report Table 1, item 37 and corresponding GALL Report Volume 2, Section IV components addressed in LRA for this Table 1 line item recommend a water chemistry program and a commitment in the FSAR supplement, as stated in SRP-LR Section 3.1.2.2.17, to manage SCC, PWSCC and IASCC for stainless steel and nickel alloy RVI components exposed to reactor coolant environments. LRA Table 3.1.1, item 37, and corresponding Table 3.1.2-1 AMR line items credit water chemistry for managing cracking in these AMRs. The staff's evaluation of the applicant's Water Chemistry program is documented in SER Section 3.0.3.1.1. On the basis of its review of this program, the staff finds that the applicant's Water Chemistry Program is consistent with the GALL Report and adequate to mitigate SCC for stainless CASS RVI components in treated water environments.

In reviewing LRA Table 3.1.1, item 37, the staff noted that the FSAR supplement commits to managing SCC, PWSCC, and IASCC; however, LRA Table 3.1.2-1 AMR line items for stainless steel and nickel alloy RVI components exposed to reactor coolant corresponding to GALL Report Volume 1, line 37 do not provide for the commitment in the FSAR supplement.

During the audit, the staff asked the applicant to revise LRA Table 3.1.2-1 AMR line items to include the commitment in the FSAR supplement.

In its letter dated August 20, 2007, the applicant stated that the LRA states a commitment (1) to participate in industry RVI aging programs, (2) to implement applicable results, and (3) to submit for NRC approval at least 24 months before the period of extended operation an RVI inspection plan based on industry recommendation. Reviews of the Table 2 items that correspond to the following Table 1 items (3.1.1-22, 3.1.1-27, 3.1.1-30, 3.1.1-33, and 3.1.1-37) demonstrates this commitment. The applicant also pointed out that Table 1, item 3.1.1-37 states that the commitment is described in the FSAR supplement with further evaluation in Subsection 3.1.2.2.17. Further, the applicant's response clarified that the commitment in the Table 1, item 3.1.1-30 applies to all corresponding Table 2 AMR lines in LRA Section 3.1.

The staff finds the applicant's response acceptable because it confirmed that the commitment in LRA Section 3.1.2.2.17 and FSAR Section A.1.1 applies to AMPs that manage SCC and IASCC for stainless steel and CASS RVI components exposed to treated water corresponding to GALL Report Table 1, item 37.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.17 criteria. For those line items that apply to LRA Section 3.1.2.2.17, 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).

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 3.1.2-6, 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 3.1.2-6, 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.

3.1.2.3.1 Reactor Vessel, Internals, and Reactor Coolant System - Summary of Aging Management Evaluation - Reactor Vessel and Internals – 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 vessel and internals component groups.

In reviewing LRA Table 3.1.2-1, the staff noted that the applicant lists stainless steel CRDM head penetration thermal sleeves exposed to treated water environments, using Notes J and 113 for this AMR line. Note J indicates that neither the component nor the material and environment combination is evaluated in the GALL Report and plant-specific Note 113 states that these aging effects do not affect the insulation intended function of the thermal sleeves; therefore, the LRA states "None" for AERM and its AMP. The staff did not agree with the applicant's elimination of an aging effect because of the intended function. The staff believed that if a component has no intended function to be managed during the period of extended operation that component should be screened out and not included in the AMR tables. During the audit, the staff asked the applicant to justify elimination of aging effect for stainless steel CRDM head penetration thermal sleeves exposed to treated water in accordance with the requirements of 10 CFR Part 54.

In its response dated August 20, 2007, the applicant revised LRA Table 3.1.2-1 to use a combination of the Water Chemistry Program and the One-Time Inspection Program to manage loss of material and cracking of stainless steel CRDM head penetration thermal sleeves exposed to treated water. The applicant's response added that the Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate cracking and loss of material aging effects. The One-Time Inspection Program either verifies that unacceptable degradation has not occurred or triggers additional actions to maintain intended functions of affected components during the period of extended operation. The staff's evaluation of the applicant's Water Chemistry Program and One-Time Inspection Program are documented in SER Section 3.0.3.1.1 and 3.0.3.1.5, respectively.

The staff finds this response acceptable because the applicant adequately revised the AMR line items in Table 3.1.2-1 to include loss of material and cracking of stainless steel CRDM head penetration thermal sleeves exposed to treated water and appropriately added the Water Chemistry and One-Time Inspection Programs to manage this aging effect.

In reviewing LRA Table 3.1.2-1, the staff noted that it indicates no aging effects for stainless steel piping, piping components, and piping elements exposed to silicone fluid environments. Note J for this AMR line indicates that neither the component nor the material and environment combination is evaluated in the GALL Report and plant-specific Note 116 states, "The silicone fluid is the capillary fluid for the instrumentation. This fluid is controlled to preclude the introduction of contaminants. The design of the component inherently resists the intrusion of water; therefore, the environment is considered benign to stainless steel." The staff agrees that chemically silicone fluid is nearly inert and has no adverse effect on stainless steel. On this basis, the staff finds that stainless steel in a silicone fluid environment exhibits no aging effect and that 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).

3.1.2.3.2 Reactor Vessel, Internals, and Reactor Coolant System - Summary of Aging Management Evaluation - Incore Instrumentation System – LRA Table 3.1.2-2

The staff reviewed LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the incore instrumentation system component groups.

In reviewing LRA Table 3.1.2-1, the staff noted that it states no aging effect and AMP for stainless steel flux thimble tubes and valves internally exposed to wetted air or gas. Note G for these line items indicates that the environment is not in the GALL Report for this component and material and Note 111 states that this internal environment is not normally likely to have condensation; however, the LRA refers to GALL Report Volume 2, item IV.E-2 for stainless steel components externally exposed to "Air - Indoor uncontrolled." The staff noted that the only GALL Report item specifically for flux thimble tubes or flux thimble isolation valves is item IV.B2-13 for flux thimble tubes in reactor coolant environments, not applicable to this LRA line item; therefore, the applicant appropriately used one of the "Common Miscellaneous Material Environmental Combinations" in GALL Report Table IV.E for determination of the aging effect for flux thimble tube surfaces exposed to air. On this basis, the staff finds the applicant's determination of no aging effect for stainless steel flux thimble tubes exposed to indoor air 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).

3.1.2.3.3 Reactor Vessel, Internals, and Reactor Coolant System - Summary of Aging Management Evaluation - Reactor Coolant System – 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 component groups.

In reviewing LRA Table 3.1.2-3, the staff noted that it indicates "Loss of Fracture Toughness Due to Thermal Embrittlement" as an aging effect or mechanism for CASS piping, piping components, and piping elements internally exposed to treated water environments. Note I for this line item indicates that neither the component nor the material and environment combination is evaluated in the GALL Report for this component, material, and environment combination. Note 109 states that elbows in the primary loop piping are fabricated from SA351 CF8A material and Note 118 states that this component has been screened and found not susceptible to thermal aging embrittlement based on information in a letter from C.I. Grimes (USNRC) to D. Walters (NEI), License Renewal Issue No. 98-0030, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Components," May 19, 2000; therefore, the LRA states "None" for the AMP required to manage loss of fracture toughness due to thermal embrittlement. During the audit the staff asked the applicant to explain how CASS piping and piping components exposed to treated water environments with loss of fracture toughness embrittlement were screened out based on the criteria in the May 19, 2000, letter.

In its response dated August 20, 2007, the applicant stated that:

> Per Table 3 of the Grimes Letter, valve bodies and pump casings do not require a susceptibility evaluation because both susceptible and non-susceptible components are examined to ASME Section XI requirements. As shown on page 3.1-62 of the LRA, CASS components of the Reactor Vessel Internals are managed by the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B.2.6) for Loss of Fracture Toughness due to Thermal Embrittlement. The remaining population of CASS components that require a susceptibility review included the Reactor Coolant Loop elbows and the Pressurizer Spray Head. The d-ferrite level for the Reactor Coolant Loop elbows was calculated as part of the leak-before-break evaluation performed in WCAP-14549-P, Addendum 1, Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for the Harris Nuclear Plant for the License Renewal Program. The reactor coolant loop elbows are low-molybdenum statically cast components. Since the maximum calculated d-ferrite level is $\leq$ 20 percent, the elbows are not susceptible to thermal aging. For the Pressurizer Spray Head, the Certified Material Test Report (CMTR) information was reviewed and the d-ferrite level calculated. The resultant d-ferrite level was below the screening threshold regardless of casting method; therefore, the Pressurizer Spray Head is not susceptible to thermal aging.
>
> Since the population of components reviewed for thermal aging were shown not to be susceptible to thermal aging, the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is not required for License Renewal.

The staff reviewed specific details of the material composition and casting methods during the audit and found the applicant's evaluation of CASS components for susceptibility to thermal aging acceptable because the applicant demonstrated that the applicable components meet the threshold established by the C. I Grimes letter dated May 19, 2000. The staff also agreed with the applicant that the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is not appropriate as the CASS components are not susceptible to thermal aging.

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).

3.1.2.3.4 Reactor Vessel, Internals, and Reactor Coolant System - Summary of Aging Management Evaluation - Reactor Coolant Pump and Motor – LRA Table 3.1.2-4

The staff reviewed LRA Table 3.1.2-4, which summarizes the results of AMR evaluations for the reactor coolant pump and motor component groups.

In reviewing LRA Table 3.1.2-4, the staff noted that it states loss of material due to galvanic corrosion as an aging effect for RCP oil spill protection system piping fabricated from carbon or low-alloy steel internally exposed to lubricating oil or hydraulic fluid environments. Note H for this line item indicates that the aging effect is not in the GALL Report for this component, material, and environment combination. The LRA credits the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage this aging effect. It also lists GALL Report item VII.G-26, for which the aging effect is loss of material due to general, pitting, and crevice corrosion.

During the audit, the staff asked the applicant to explain why the LRA refers to GALL Report item VII.G-26 for this line item and the how Lubricating Oil Analysis and One-Time Inspection Programs manage loss of material due to galvanic corrosion when aging mechanisms are not defined in LRA Sections B.2.18 and B.2.25.

In its response dated August 20, 2007, the applicant stated that the LRA refers to GALL Report, item VII.G 26 (A 83) for this item because the component has been subject to loss of material due to general, pitting, and crevice corrosion. The applicant added that this AMR line item environment is lubricating oil. The oil collection piping consists of both carbon steel and stainless steel sections. Carbon steel piping is connected to stainless steel piping and, as the lubricating oil can contain moisture, "galvanic corrosion" is an aging mechanism. Consistent with the GALL Report, the Lubricating Oil Analysis Program "maintains oil systems contaminants (primarily water and particulates) within acceptable limits." Therefore, because galvanic corrosion requires an electrolyte for the mechanism to occur, the program is appropriate to manage the aging effect. No operating experience suggests loss of material for these components; therefore, the One-Time Inspection Program is adequate to verify whether the aging effect occurs. The staff's evaluation of the applicant's Lubricating Oil Analysis Program and One-Time Inspection Program are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

The staff finds the applicant's response acceptable because it conservatively determined loss of material due to galvanic corrosion as an aging effect for the carbon or low-alloy steel RCP oil spill protection system piping exposed to lubricating oil and appropriately explained how this aging effect is managed by HNP AMPs.

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).

3.1.2.3.5 Reactor Vessel, Internals, and Reactor Coolant System - Summary of Aging Management Evaluation - Pressurizer – LRA Table 3.1.2-5

The staff reviewed LRA Table 3.1.2-5, which summarizes the results of AMR evaluations for the pressurizer component groups.

In reviewing LRA Table 3.1.2-5, the staff noted that it states "Loss of Fracture Toughness Due to Thermal Embrittlement" as an aging effect or mechanism for CASS pressurizer spray heads exposed to treated water environments. Note I for this line item indicates that neither the component nor the material and environment combination is evaluated in the GALL Report for this component, material, and environment combination. Note 109 states that elbows in the primary loop piping are fabricated from SA351 CF8A material and Note 118 states that this component has been screened and found not susceptible to thermal aging embrittlement based on information in a letter from C.I. Grimes (NRC) to D. Walters (NEI), License Renewal Issue No. 98-0030, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Components," May 19, 2000; therefore, the LRA states "None" for the AMP required to manage loss of fracture toughness due to thermal embrittlement. During the audit the staff asked the applicant to explain how CASS pressurizer spray head exposed to treated water environments with loss of fracture toughness embrittlement were screened out based on the criteria in the May 19, 2000 letter.

In its letter dated August 20, 2007, the applicant stated that:

> Per Table 3 of the Grimes Letter, valve bodies and pump casings do not require a susceptibility evaluation because both susceptible and non-susceptible components are examined to ASME Section XI requirements. As shown on page 3.1-62 of the LRA, CASS components of the Reactor Vessel Internals are managed by the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B.2.6) for Loss of Fracture Toughness due to Thermal Embrittlement. The remaining population of CASS components that require a susceptibility review included the Reactor Coolant Loop elbows and the Pressurizer Spray Head. The d-ferrite level for the Reactor Coolant Loop elbows was calculated as part of the leak-before-break evaluation performed in WCAP-14549-P, Addendum 1, Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for the Harris Nuclear Plant for the License Renewal Program. The reactor coolant loop elbows are low-molybdenum statically cast components. Since the maximum calculated d-ferrite

level is ≤ 20 percent, the elbows are not susceptible to thermal aging. For the Pressurizer Spray Head, the Certified Material Test Report (CMTR) information was reviewed and the d-ferrite level calculated. The resultant d-ferrite level was below the screening threshold regardless of casting method; therefore, the Pressurizer Spray Head is not susceptible to thermal aging.

Since the population of components reviewed for thermal aging were shown not to be susceptible to thermal aging, the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is not required for License Renewal.

The staff reviewed specific details of the material composition and casting methods during the audit and found the applicant's evaluation of the CASS components for susceptibility to thermal aging acceptable because the applicant demonstrated that the applicable components meet the threshold established by the C. I Grimes letter dated May 19, 2000. The staff also agreed with the applicant that the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is not appropriate because the CASS components are not susceptible to thermal aging.

In reviewing LRA Table 3.1.2-5, the staff noted it includes AMR entries for the pressurizer spray nozzle and surge nozzle thermal sleeves exposed to treated water. The AMR line items assuring the M-6 intended function of the thermal sleeves (*i.e.*, a thermal insulation function) conclude that there were no AERMs. In these AMR items Footnote 113 states that loss of material and cracking are aging effects but need no management because they will not impact the ability of the thermal sleeves to perform the M-6 thermal insulation function. During the audit, the staff requested from the applicant technical basis for the conclusion that loss of material and cracking in these thermal sleeves do not reduce or eliminate their ability to insulate the pressurizer spray and surge nozzles from the impacts of thermal cycling.

In its response dated December 11, 2007, the applicant revised the LRA Table 3.1.2-5 AMR line items for the pressurizer surge and spray nozzles thermal sleeves to change the aging effects in treated water to SCC and loss of material due to crevice and pitting corrosion. For these components SCC will be managed by a combination of the Water Chemistry Program and the One-Time Inspection Program. The Water Chemistry Program will manage loss of material for stainless steel pressurizer spray and surge nozzle thermal sleeves exposed to treated water. The applicant's response added that the Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the cracking and loss of material aging effects. The One-Time Inspection Program either verifies that unacceptable degradation has not occurred or triggers additional actions to maintain intended functions of affected components during the period of extended operation. The staff's evaluation of the applicant's Water Chemistry Program and One-Time Inspection Program are documented in SER Section 3.0.3.1.1 and 3.0.3.1.5, respectively.

The staff finds this response acceptable because it adequately revised the AMR line items in Table 3.1.2-1 to include loss of material and cracking of stainless steel pressurizer spray and surge nozzles thermal sleeves exposed to treated water and appropriately added the Water Chemistry and One-Time Inspection Programs for managing these aging effects.

LRA Table 3.1.2-5 proposes to use the Bolting Integrity Program for managing loss of material due to wear for pressurizer manway nuts and studs fabricated of high-strength carbon or low-alloy steel in indoor air environments. Note H for this AMR result indicates that the aging effect is not in the GALL Report for this component, material, and environment combination. For similarity, LRA Table 3.1.2-5 for this AMR line refers to GALL Report item IV.C2-8, which recommends the Bolting Integrity Program for managing loss of preload for low-alloy closure bolting in air. The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description states the program utilizes industry recommendations and EPRI guidance that considers material properties, joint-gasket design, chemical control, service requirements, and industry and plant-specific operating experience in specifying torque and closure requirements. On the basis of its review of plant-specific and industry operating experience, the staff determined that use of the Bolting Integrity Program to manage loss of material due to wear is a conservative approach; therefore, the staff finds that the aging effect of loss of material due to wear in pressurizer manway nuts and studs is effectively managed by the Bolting Integrity Program.

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).

3.1.2.3.6 Reactor Vessel, Internals, and Reactor Coolant System - Summary of Aging Management Evaluation - Steam Generator – LRA Table 3.1.2-6

The staff reviewed LRA Table 3.1.2-6, which summarizes the results of AMR evaluations for the steam generator component groups.

In reviewing LRA Table 3.1.2-6, the staff noted that it includes several AMR items on loss of material due to pitting and crevice corrosion and on SCC in feedwater nozzle and auxiliary feedwater nozzle thermal sleeves exposed to treated water and credits the Water Chemistry Program and the One-time Inspection Program to manage these component aging effects. The staff determined that the scope of the One-Time Inspection Program, as stated in the LRA, does not specifically include the feedwater nozzle and auxiliary feedwater nozzle thermal sleeves. During the audit, the staff asked the applicant:

a. To clarify whether any other AMPs credited periodically examine these thermal sleeves. If there are alternate AMPs, why it is acceptable to credit the One-Time Inspection Program as the means of managing loss of material and cracking of these thermal sleeves in lieu of the alternate AMPs? Amend AMP B.1.28, "One-Time Inspection Program," to include the feedwater nozzle and auxiliary feedwater nozzle thermal sleeves within the scope of the AMP.

b. The staff opinion is that cracking or loss of material in the feedwater and auxiliary feedwater nozzle thermal sleeves may impact their ability to protect the feedwater and auxiliary feedwater nozzles from thermal cycling and thus their M-6 thermal insulation function. Provide your technical basis for concluding that loss of material or cracking would not impact the M-6 thermal insulation function for these thermal sleeves.

In its response dated August 20, 2007, the applicant stated that:

a. Loss of material from pitting and crevice corrosion and cracking from SCC of the feedwater nozzle thermal sleeves and auxiliary feedwater nozzle thermal sleeves are managed by a combination of the Water Chemistry Program and the One-Time Inspection Program. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the subject aging effects. The One-Time Inspection Program provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

   The basis document for the One-Time Inspection Program includes the feedwater nozzle thermal sleeves and auxiliary feedwater nozzle thermal sleeves in the one-time inspections to verify effectiveness of the Water Chemistry Program. This level of detail is not provided in the LRA AMP description.

b. The LRA and the bases documents for the Water Chemistry and One-Time Inspection Program will be amended/revised to include, for the feedwater and auxiliary feedwater nozzles' M-6 Function, the Water Chemistry and One-Time Inspection Programs to manage the aging effects.

During the audit, the staff reviewed the Water Chemistry Program and One-Time Inspection Program bases documents and finds the applicant's response acceptable because it committed to revise the LRA and the bases documents for the feedwater and auxiliary feedwater nozzle thermal sleeves with thermal insulation intended function (M-6 Function) to include the Water Chemistry and One-Time Inspection Programs to manage the cracking and loss of material aging effects.

In reviewing LRA Table 3.1.2-6, the staff noted that it credits the One-Time Inspection Program to manage loss of material due to general, pitting, or crevice corrosion, and in some cases SCC, in the following component commodity groups:

- steam generator feedwater impingement plate and support
- feedwater distribution ring and support
- feedwater distribution ring spray nozzles
- auxiliary feedwater internal spray pipe
- moisture separator assembly
- miscellaneous nonpressure boundary steam generator internals

(a) The staff noted that the steam generator feedwater impingement plate and support, feedwater distribution ring and support, feedwater distribution ring spray nozzle, and auxiliary feedwater internal spray pipe commodity groups are within the scope of AMP B.2.18, "One-Time Inspection Program." The staff asked the applicant to clarify whether any other AMPs credited in the LRA periodically examine these commodity groups and, if so, why it credits the One-Time Inspection Program for managing loss of material (and in some cases cracking) in these commodity groups in lieu of the alternate AMPs.

(b) The staff determined that the One-Time Inspection Program does not specify that the steam generator moisture separator assembly is within its scope. The staff asked the applicant to clarify whether any other AMPs credited in the LRA periodically examine the steam generator moisture separator assembly and, if so, why it credits the One-Time Inspection Program for managing loss of material in this component in lieu of crediting the alternate AMPs. The staff asked the applicant to amend AMP B.2.18, "One-Time Inspection Program," appropriately to include the steam generator moisture separator assembly within its scope if the component is not included.

(c) The staff also asked the applicant to define the specific steam generator commodity groups the term "Miscellaneous Non-Pressure Boundary Internals," and to state why it is acceptable to credit the One-Time Inspection Program for managing loss of material and cracking in each of these steam generator nonpressure boundary internals. The staff asked the applicant to amend the One-Time Inspection Program specifically to place these nonpressure boundary internals with the scope of this AMP.

In its response dated August 20, 2007, the applicant stated that:

The One-Time Inspection Program basis document provides a description of Program Scope by tabulating for each material-environment combination: system number/system name, and component inspected/description. Each table also provides aging effects and component intended functions.

a. The steam generator feedwater impingement plate and support, feedwater distribution ring and support, feedwater distribution ring spray nozzles, auxiliary feedwater internal spray pipe commodity groups are managed by the Water Chemistry Program and the One-Time Inspection Program.

For those components that are carbon steel, the aging effects managed are loss of material from pitting, crevice and general corrosion. For those components that are nickel based alloys, the aging effects managed are loss of material from pitting and crevice corrosion and SCC.

The basis for why it acceptable to credit the Water Chemistry Program and the One-Time Inspection Program as the means for managing the subject aging effects is as follows:

Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the subject aging effects. The

One-Time Inspection Program provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

In addition to the prevention and mitigation of the aging effects provided by the Water Chemistry Program, the One Time Inspection Program will rely on established NDE techniques, including visual, and/or volumetric techniques that are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR 50, Appendix B. The inspection and test techniques will have a demonstrated history of effectiveness in detecting the aging effect of concern. Evidence of degradation will result in evaluation by Engineering for repair/replacement in accordance with the Corrective Action Program. Acceptance criteria will be based on construction code, manufacturer's recommendations, engineering evaluation, or metallurgical examination, as appropriate.

b. The steam generator moisture separator assembly commodity group is managed by the Water Chemistry Program and the One-Time Inspection Program. For the carbon steel steam generator moisture separator assembly, the aging effects managed are loss of material from pitting, crevice and general corrosion.

The basis for why it acceptable to credit the Water Chemistry Program and the One-Time Inspection Program as the means for managing the subject aging effects is as follows:

Water Chemistry Program monitors and controls water chemistry using site procedures and processes for the prevention or mitigation of the subject aging effects. The One-Time Inspection Program provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

In addition to the prevention and mitigation of the aging effects provided by the Water Chemistry Program, the One Time Inspection Program will rely on established NDE techniques, including visual, and/or volumetric techniques that are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR 50, Appendix B. The inspection and test techniques will have a demonstrated history of effectiveness in detecting the aging effect of concern. Evidence of degradation will result in evaluation by Engineering for repair/replacement in accordance with the Corrective Action Program. Acceptance criteria will be based on construction code, manufacturer's recommendations, engineering evaluation, or metallurgical examination, as appropriate.

The basis document for the One-Time Inspection Program includes the subject components in the one-time inspections to verify effectiveness of the Water

Chemistry Program. This level of detail is not provided in the LRA AMP description.

c. The steam generator Miscellaneous Non-Pressure Boundary Internals commodity group is managed by the Water Chemistry Program and the One-Time Inspection Program. For those components that are carbon steel, the aging effects managed are loss of material from pitting, crevice and general corrosion. For those components that are nickel based alloys or stainless steel, the aging effects managed are loss of material from pitting and crevice corrosion and SCC.

   Examples of the steam generator Miscellaneous Non-Pressure Boundary Internals include, primary separators, secondary separator vanes, various plates, stay rods and spacer pipes. These components will be added to the basis document Evaluation Group Tables.

   The basis for why it acceptable to credit the Water Chemistry Program and the One-Time Inspection Program as the means for managing the subject aging effects is as follows:

   Water Chemistry Program monitors and controls water chemistry using site procedures and processes for the prevention or mitigation of the subject aging effects. The One-Time Inspection Program provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

   In addition to the prevention and mitigation of the aging effects provided by the Water Chemistry Program, the One Time Inspection Program will rely on established NDE techniques, including visual, and/or volumetric techniques that are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR 50, Appendix B. The inspection and test techniques will have a demonstrated history of effectiveness in detecting the aging effect of concern. Evidence of degradation will result in evaluation by Engineering for repair/replacement in accordance with the Corrective Action Program. Acceptance criteria will be based on construction code, manufacturer's recommendations, engineering evaluation, or metallurgical examination, as appropriate.

   The basis document for the One-Time Inspection Program includes the subject components in the one-time inspections to verify effectiveness of the Water Chemistry Program. This level of detail is not provided in the LRA AMP description.

The staff determined that the Water Chemistry Program and the One Time Inspection Program will be adequate to manage (a) loss of material from pitting, crevice, and general corrosion for carbon steel components and SCC and loss of material from pitting, crevice, and general corrosion for nickel-based alloy components, (b) loss of material from pitting, crevice, and general corrosion for the carbon steel steam generator moisture separator assembly, and (c) loss of material from pitting, crevice, and general corrosion for carbon steel and SCC and loss of material from pitting, crevice and general corrosion for nickel-based alloy components in the *steam generator* Miscellaneous Non-Pressure Boundary Internals *commodity group* of LRA Table 3.1.2-6.

The applicant proposed to manage the aging effect of cracking due to thermal fatigue in stainless steel instrument manifolds and valves exposed to treated water environments using a TLAA evaluated for the period of extended operation. The applicant used Note F for this AMR result, indicating that the material is not in the GALL Report for this component. The staff's review of the applicant's evaluation of this TLAA is documented in SER Section 4.3. On the basis of its review of this TLAA, the staff finds the AMR result acceptable.

The applicant proposed to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces in nickel alloy steam generator tubes exposed to treated water using the Water Chemistry Program. The applicant used Notes H and 117 for these AMR results. Note H indicates that aging effect is not in the GALL Report for this component, material, and environment combination and Note 117 states, "No HNP operating experience has been identified for fouling of steam generator tubes. The absence of fouling is considered largely due to the plant water chemistry program; therefore, Reduction of Heat Transfer has been identified as an aging effect that is managed by water chemistry." The staff's evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.1.1. The program monitors and controls water chemistry using procedures and processes to prevent or mitigate the loss of material and cracking aging effects.

On the basis of its review of plant-specific and industry operating experience, the staff finds that the environment of these components will be monitored and controlled and the aging effect of reduction of heat transfer effectiveness due to fouling in steam generator tubes exposed to treated water will be effectively mitigated by the Water Chemistry Program.

The applicant proposed the Water Chemistry Program and the Steam Generator Tube Integrity Program to manage loss of material due to crevice and pitting corrosion in stainless steel steam generator tube support plates and flow distribution baffles fabricated of stainless steel in treated water. The applicant used Note F, which indicates that the material is not in the GALL Report for this component. The Water Chemistry Program monitors and controls water chemistry using procedures and processes to prevent or mitigate the loss of material and cracking aging effects. The Steam Generator Tube Integrity Program manages aging effects by a balance of prevention, inspection, evaluation, repair, and leakage monitoring. The staff's evaluation of the applicant's Water Chemistry program is documented in SER Section 3.0.3.1.1, of the applicant's Steam Generator Tube Integrity Program in SER Section 3.0.3.2.6.

On the basis of its review of plant-specific and industry operating experience, the staff finds that the aging effect of loss of material due to crevice and pitting corrosion in the steam generator support plates and flow distribution baffles exposed to treated water will be effectively managed by the Water Chemistry and Steam Generator Tube Integrity Programs.

The applicant proposed the Water Chemistry and Steam Generator Tube Integrity Programs to manage loss of material due to pitting corrosion in steam generator anti-vibration bars fabricated of stainless steel and nickel alloy in treated water. The applicant used Note H, which indicates that the aging effect is not in the GALL Report for this component, material, and environment combination. The Water Chemistry Program monitors and controls water chemistry using procedures and processes to prevent or mitigate the loss of material and cracking aging effects. The Steam Generator Tube Integrity Program manages aging effects by a balance of prevention, inspection, evaluation, repair, and leakage monitoring. The staff's evaluation of the applicant's Water Chemistry program is documented in SER Section 3.0.3.1.1, of the applicant's Steam Generator Tube Integrity Program in SER Section 3.0.3.2.6.

On the basis of its review of plant-specific and industry operating experience, the staff finds the aging effect of loss of material due to pitting corrosion in the steam generator anti vibration bars exposed to treated water effectively managed by the Water Chemistry and Steam Generator Tube Integrity Programs.

The applicant proposed the Water Chemistry Program to manage SCC in the steam nozzle flow limiters fabricated of nickel-base alloy and exposed to treated water. Note H for these AMR results indicates that aging effect is not in the GALL Report for this component, material, and environment combination and Note 108 states that for the purposes of alignment the steam nozzle flow limiter is an extension of the Main Steam System as described in GALL Report item VIII.B1. The staff's evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.1.1. The program monitors and controls water chemistry using procedures and processes to prevent or mitigate the loss of material and cracking aging effects.

On the basis of its review of plant-specific and industry operating experience, the staff finds that the environment of these components will be monitored and controlled and the aging effect of SCC in steam nozzle flow limiters exposed to treated water effectively mitigated by the Water Chemistry Program.

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 reactor vessel, RVI, 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 System

This section of the SER documents the staff's review of the applicant's AMR results for the engineered safety feature system components and component groups of:

- containment spray system
- containment isolation system
- high-head safety injection system
- low-head safety injection and residual heat removal system
- passive safety injection system
- control room area ventilation system

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the engineered safety feature system components and component groups. LRA Table 3.2.1, "Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the engineered safety feature system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience 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 operating experience included a review of the GALL Report and operating experience 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 feature 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 3.2.2.1.

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 operating experience 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 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 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, which recommends further evaluation (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 HNP (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 (See SER Section 3.2.2.2.3)

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 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 HNP (See SER Section 3.2.2.2.3)
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	Not applicable	Not applicable to PWRs (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	Not applicable	Not applicable to HNP (See SER Section 3.2.2.2.3)
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	One-Time Inspection (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.3)
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	Not applicable to HNP (See SER Section 3.2.2.2.3)
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	Lubricating Oil Analysis Program (B.2.25) and One-Time Inspection (B.2.18)	Not applicable to ESFS (See SER Section 3.2.2.2.4)

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
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	Water Chemistry (B.2.2) and One-Time Inspection (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.4)
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	Not applicable	Not applicable to PWRs (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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Not applicable to ESFS (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	Not applicable to PWRs (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	Not applicable	Not applicable to PWRs (See SER Section 3.2.2.2.8)
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 (See SER Section 3.2.2.2.8)

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 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.2.25) and One-Time Inspection (B.2.18)	Not applicable to ESFS (See SER Section 3.2.2.2.8)
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 microbiologically -influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Not applicable	Not applicable to HNP (See SER Section 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 stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to PWRs
Steel piping, piping components, and piping elements exposed to steam or treated water (3.2.1-19)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to PWRs
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 to PWRs
High-strength steel closure bolting exposed to air with steam or water leakage (3.2.1-21)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable	Not applicable to HNP (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
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.2.8)	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.2.8)	Consistent with GALL Report
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	Bolting Integrity Program (B.2.8)	Consistent with GALL Report
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 stress corrosion cracking	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program (B.2.11)	Consistent with GALL Report
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 HNP (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	Closed-Cycle Cooling Water System Program (B.2.11)	Consistent with GALL Report
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	Closed-Cycle Cooling Water System Program (B.2.11)	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, 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	Not applicable	Not applicable to HNP (See SER Section 3.2.2.1.1)
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	Closed-Cycle Cooling Water System Program (B.2.11)	Consistent with GALL Report
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	Not applicable	Not applicable to HNP (See SER Section 3.2.2.1.1)
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	Not applicable	Not applicable to HNP (See SER Section 3.2.2.1.1)
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 HNP (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
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	Not applicable to HNP (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 microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to HNP (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 microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to HNP (See SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.2.1-37)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to HNP (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 microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to HNP (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 microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to HNP (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
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	Not applicable	Not applicable to HNP (See SER Section 3.2.2.1.1)
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	Not applicable	Not applicable to HNP (See SER Section 3.2.2.1.1)
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	Not applicable	Not applicable to HNP (See SER Section 3.2.2.1.1)
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 HNP (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 HNP (See SER Section 3.2.2.1.1)
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	Boric Acid Corrosion Program (B.2.4)	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 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 HNP (See SER Section 3.2.2.1.1)
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 HNP (See SER Section 3.2.2.1.1)
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 stress corrosion cracking	Water Chemistry	No	Water Chemistry Program (B.2.2)	Consistent with GALL Report
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	Water Chemistry Program (B.2.2)	Consistent with GALL Report
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
Galvanized steel ducting exposed to air - indoor controlled (external) (3.2.1-51)	None	None	No	Not applicable	Not applicable to HNP (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
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	Not applicable	Not applicable to HNP (See SER Section 3.2.2.1.1)
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 HNP (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 HNP (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	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 (3.2.1-57)	None	None	No	None	Consistent with GALL Report

The staff's review of the engineered safety features system 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 system 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 system components:

- Water Chemistry Program
- Boric Acid Corrosion Program
- Bolting Integrity Program
- One-Time Inspection Program
- External Surfaces Monitoring Program
- Closed Cycle Cooling Water System Program

LRA Tables 3.2.2-1 through 3.2.2-4 summarize AMRs for the engineered safety features 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's evaluation follows.

3.2.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.2.1 shows items 3.2.1-02, -03, -04, -05, -06, -08, -09, -11, -12, -13, -14, -15, -16, -17, -18, -19, -20, -21, -26, -29, -31, -32, -33, -34, -35, -36, -37, -38, -39, -40, -41, -42, -43, -44, -46, -47, -51, -52, -54, and -55 as "Not Applicable" as either there is no such component, material, and environment combination for HNP engineered safety feature systems, the combination is present at BWR plants only, or the components are evaluated with their parent systems in other sections. For each of these items, the staff reviewed the LRA and supporting documents and confirmed the applicant's claim that the component, material, and environment combination does not exist in HNP engineered safety feature systems. On the basis that HNP engineered safety feature systems do not have the component, material, and environment combination for these Table 1 items, the staff concurs with the applicant's conclusion that these AMRs do not apply to HNP engineered safety feature systems.

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).

3.2.2.2 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 system components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to cladding breach
- 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 due to cladding breach, stating that this aging effect is not present because the charging pumps are fabricated from stainless steel and not from carbon steel with stainless steel cladding.

SRP-LR Section 3.2.2.2.2 and GALL Report, Volume 1, Table 2, AMR Item 2, state that loss of material due to cladding breach may occur in PWR steel pump casings with stainless steel cladding exposed to treated borated water.

Based on the review of the LRA and the applicant's supporting documents, the staff confirmed that residual heat removal pumps, containment spray pumps, and safety-injection/charging pumps are fabricated from stainless steel and not from carbon steel with interior stainless steel cladding surfaces. Based on this review, the staff concludes that the AMR evaluation in SRP-LR Section 3.2.2.2.2 and GALL Report, Volume 1, Table 2, AMR Item 2, do not apply to HNP engineered safety feature systems because there are no steel pump casings with stainless steel cladding exposed to treated borated water in the engineered safety feature systems at HNP.

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 internal surfaces of stainless steel containment isolation components, stating that such internal surfaces exposed to treated water are evaluated with their parent system. If loss of material due to pitting and crevice corrosion occurs, an appropriate AMP is credited.

SRP-LR Section 3.2.2.2.3 and GALL Report, Volume 1, Table 2, AMR Item 3, state 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.

The discussion column of Table 3.2.1, item 3.2.1-03, applicant states that HNP manages loss of material due to pitting and crevice corrosion of stainless steel containment isolation piping and components internal surfaces exposed to treated water with a combination of the Water Chemistry Program and the One-Time Inspection Program consistent with the GALL Report.

The staff reviewed the Water Chemistry Program, which monitors chlorides, fluorides, and dissolved oxygen to limit the contaminants, minimize the occurrences of aging effects, and maintain component ability to perform intended functions. The applicant stated that the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Program and confirm the absence of any aging effect. The One-Time Inspection Program inspects select stainless steel components exposed to treated water at susceptible locations like stagnant areas for loss of material due to pitting and crevice corrosion in engineered safety feature systems. The staff evaluations of the Water Chemistry Program and the One-Time Inspection Program are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively. The staff finds these programs consistent with GALL Report recommendations and adequate to manage loss of material due to pitting and crevice corrosion on internal surfaces of stainless steel containment isolation piping and components exposed to treated water.

However, the applicant stated that the internal surfaces of containment isolation piping and components exposed to treated water are being evaluated with their parent system. The staff determined that the applicant should have aligned this AMR to GALL Report, Volume 2, AMR Item V.C-2, and not to AMR Item V.A-27.

The staff's review of LRA Section 3.2.2.2.3 identified an area in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.2-1, Part A, dated January 7, 2008, the staff asked the applicant to justify referencing GALL AMR Item V.A-27 in lieu of AMR Item V.C-4 for stainless steel containment isolation piping and component surfaces that are exposed to a treated water environment. Specifically, the staff asked the applicant to provide its basis for not coupling a one-time inspection of these components to the Water Chemistry Program to manage loss of material due crevice corrosion and pitting corrosion in the components, as is recommended in GALL Report, Volume 2, AMR Item V.C-4.

In its response dated January 17, 2008, the applicant clarified that the water inventory in the subject components is borated and that due to this environment, the AMR for these components is consistent with the AMR provided by the staff in GALL AMR Item V.A-27. In GALL AMR Item V.A-27, the staff does not recommend that a one-time inspection be coupled with an applicant's Water Chemistry Program because the treated water environment is treated with boric acid, which is an effective corrosion inhibitor. Thus the staff's recommendation in GALL AMR Item V.A-27 considers that the Water Chemistry Program would be sufficient to mitigate loss of material due to pitting or crevice corrosion in stainless steel ESF components that are exposed to a borated, treated water environment.

Based on its review, the staff finds the applicant's response to RAI 3.2-1, Part A, acceptable because the applicant clarified that the environment is that for borated treated water. The staff concludes that it is valid for the applicant to use GALL AMR Item V.A-27 as the basis for the applicant's AMR on loss of material due to pitting or crevice corrosion for the stainless piping, piping components, piping elements, and tanks that are exposed to a borated treated water environment. The staff's concern described in RAI 3.2-1, Part A, is resolved.

(2) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in buried stainless steel components, stating that this aging effect is not present because the engineered safety feature systems have no piping components exposed to soil.

SRP-LR Section 3.2.2.2.3 and GALL Report, Volume 1, Table 2, AMR Item 4, state that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, and piping elements exposed to soil.

Based on the review of the LRA and the applicant's supporting documents, the staff confirmed that the engineered safety feature systems have no piping components exposed to soil and concludes that the AMR evaluation in SRP-LR Section 3.2.2.3.2 and GALL Report, Volume 1, Table 2, AMR Item 4, do not apply to HNP engineered safety feature systems because there are no stainless steel piping, piping components, or piping elements in engineered safety feature systems exposed to soil.

(3) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in BWR stainless steel and aluminum piping, stating that this aging effect does not apply to HNP, a PWR plant.

SRP-LR Section 3.2.2.2.3 and GALL Report, Volume 1, Table 2, AMR Item 5, state 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.

This further evaluation does not apply to HNP, a PWR plant.

(4) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in stainless steel and copper alloy piping components in lubricating oil, stating that loss of material could occur for stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil. Components exposed to lubricating oil are charging and safety injection pumps.

SRP-LR Section 3.2.2.2.3 and GALL Report, Volume 1, Table 2, AMR Item 6, state that loss of material due to pitting and crevice corrosion may occur in engineered safety feature 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 discussion column of LRA Table 3.2.1, AMR item 3.2.1-06, states that the AMPs credited to manage loss of material due to pitting and crevice corrosion of stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil are the Lubricating Oil Analysis Program and One-Time Inspection Program. The applicant clarified that LRA Section 3.3.2.1.1 further evaluates this item and that the Type 2 AMR items for these engineered safety feature components are in LRA Table 3.3.2-1.

The staff verified that the AMR items for these engineered safety feature components are in LRA Table 3.3.2-1, including the charging and safety-injection pump (CSIP) gear lube oil pumps, gear oil cooler components, and the charging and safety-injection pump lube oil components. The staff also verified that the AMR items for these components credit both the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage loss of material due to pitting and crevice corrosion for component surfaces exposed to lubricating oil. The staff's evaluation of the applicant's Lubricating Oil Analysis Program and One-Time Inspection Program is documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. On this basis, the staff finds that the Lubricating Oil Analysis Program and One-Time Inspection Programs adequately manage loss of material due to pitting and crevice corrosion for CSIP subcomponents exposed to lubricating oil.

(5) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in bottom surfaces of stainless steel tanks, stating that loss of material due to pitting, crevice, and MIC could occur for stainless steel tank bottoms exposed to raw water. The refueling water storage tank rests on a concrete pad. Although not a partially-encased tank with a moisture barrier as described in the GALL Report, the refueling water storage tank enclosure is subject to radio-chemistry controls; therefore, it is not drained automatically. Rainwater pool levels in the tank area could exceed the top of the 6-in. tank pad, and rainwater (raw water) could seep into the gap below the tank bottom. Loss of material will be managed by the One-Time Inspection Program, which either verifies that unacceptable degradation has not occurred or triggers additional actions to maintain the intended function(s) of affected components during the period of extended operation.

SRP-LR Section 3.2.2.2.3 and GALL Report, Volume 1, Table 2, AMR Item 7, state 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 applicant proposed the One-Time Inspection Program to manage loss of material due to pitting and crevice corrosion for bottom surfaces of stainless steel tanks. The staff asked the applicant for the basis for crediting the One-Time Inspection Program to manage such loss of material for bottom surfaces of stainless steel refueling water storage tank exposed to raw water environments.

The applicant responded that this item represents corrosion resulting from water seepage underneath the refueling water storage tank. The tank area enclosure for the refueling water storage tank does not drain automatically; therefore, standing rainwater may accumulate to levels above the tank pad elevation.

Chemistry procedures guide sampling of drainage water before its release from the tank area. Results of sampling for radioactive contamination are reported to operations for release of the water to storm drain system or its return for liquid radwaste system processing.

The staff noted that the One-Time Inspection Program is normally used to verify the effectiveness of other mitigative or preventative programs, such as chemistry control programs, and do not include procedures to enhance the environment so that it is not conducive to pitting and crevice corrosion.

The staff's review of LRA Section 3.2.2.2.3 identified areas in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.2-1, Part B, dated January 7, 2008, the staff asked the applicant to provide its basis for crediting the One-Time Inspection Program alone to manage loss of material due to pitting and crevice corrosion for items referencing LRA Item 3.2.1-7, and why the Water Chemistry Program is also not credited for these tanks, particularly when the applicant is relying on plant-specific chemistry procedures to sample and test the water inventory in these tanks.

In its response dated January 17, 2008, the applicant clarified that the AMR on loss of material due to pitting or crevice corrosion applies to the external surfaces of the bottom surface of the refueling water storage tank and that the environment for these component surface is external raw water. The applicant clarified that the AMR for the bottom external surface of the refueling water storage tank is that for rainwater. The applicant clarified that the applicant samples the rainwater dripping from the tanks only to do an assay of the entrapped rainwater to ensure that no radioactive contamination of the outside environment is occurring and that the testing is not for the presence of ionic chemical species. Thus, the applicant has clarified that its Water Chemistry Program does not rely on testing of rainwater seepage for ionic impurities.

Based on its review, the staff finds the applicant's response to RAI 3.2-1, Part B, acceptable because the applicant clarified that the testing of the rainwater is only for radioactive contamination. The staff concludes that the applicant does not rely on its Water Chemistry Program to control potential corrosion in the external surfaces that are exposed to the external raw water/entrapped rainwater environment and that, as such, the applicant does not need to couple the Water Chemistry Program to the One-Time Inspection Program that the applicant has credited for the external refueling water storage tank bottom surface. The staff's concern described in RAI 3.2-1, Part B, is resolved.

From industry operating experience, the staff recognizes that stainless steel components exposed to accumulated water for limited durations should not experience significant degradation. The staff finds a one-time inspection to confirm whether significant degradation has occurred acceptable. The staff's evaluation of the applicant's One-Time Inspection Program is documented in SER 3.0.3.1.5. The staff determined that this program's inspections and NDE examination techniques are consistent with GALL Report recommendations and adequate to detect loss of material due to pitting and crevice corrosion for stainless steel tanks exposed to raw water. On this basis, the staff finds that the applicant has met the criteria of SRP-LR Section 3.2.2.2.3, item 5, for further evaluation.

(6) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in stainless steel components exposed to internal condensation, stating that this aging effect is not present because HNP Engineered safety feature systems do not have this material and environment combination.

SRP-LR Section 3.2.2.2.3 and GALL Report, Volume 1, Table 2, AMR Item 8, state 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.

In RAI 3.2-2 dated January 7, 2008, the staff asked the applicant to provide its basis for concluding that the ESF systems do not include stainless steel components or component areas that are exposed to or subject to internal condensation.

In its response dated January 17, 2008, the applicant clarified that the AMRs refer to the internal gas/water interfaces for the following stainless steel components:

- in the containment spray system: the refueling water storage tank and the containment spray additive tank
- in the passive safety injection system: the cold leg accumulators

The applicant clarified that the atmospheric environment for two of these component types, (i.e., for the containment spray additive tank and the cold leg accumulators) is that for dry nitrogen and that this gas does not create an environment which is conducive for condensation. Dry nitrogen gas is an inert dry gaseous environment. This environment does not create opportunities for water condensation on the internal surfaces of the components exposed to the nitrogen environment and does not create an atmospheric environment that is conducive to the initiation of corrosion (i.e. the dry nitrogen gas creates an inerted condition for stainless steel surfaces that are in contact with it). This is consistent with the basis for gas environments as discussed in GALL Report, Revision 1, Volume 2, Table IX.D.

Based on this assessment, the staff finds the applicant's response to RAI 3.2-2 acceptable because the internal surfaces of the cold leg accumulators and containment spray additive tank that are exposed to dry nitrogen gas would not be subject to condensation or corrosion resulting from condensation. The staff's concern described in RAI 3.2-2 is resolved with respect to assessing whether condensation is an applicable environment for the internal cold leg accumulator and contains spray additive tank surfaces that are inerted with dry nitrogen gas.

For the refueling water storage tank, the applicant also clarified that the refueling water storage tank is a covered tank and that the internal uncontrolled air atmosphere for the refueling water storage tank is periodically vented to the outside atmosphere. The applicant also clarified that, other than during refueling outages, the refueling water storage tank is not normally subjected to large volume changes of its borated water inventory or to concomitant exchanges of internal air environment. The applicant's venting of the internal air atmosphere in the refueling water storage tank will mitigate the probability that condensation will occur on the internal surfaces that are exposed to the air environment. In addition, stainless steel components are designed to resist corrosion under exposure to uncontrolled air or air with condensation environments.

Based on this assessment, the staff finds the applicant's response to RAI 3.2-2 acceptable because the internal condensation is not expected for the internal surfaces of the refueling water storage tank that are exposed to the air environment because the applicant vents the system frequently enough to prevent a stagnant uncontrolled air atmosphere, that if otherwise present, could potentially induce condensation on the internal refueling water storage tank surfaces in contact with the air. The staff's concern described in RAI 3.2-2 is resolved with respect to assessing whether condensation is an applicable environment for the internal refueling water storage tank surfaces that are exposed to an uncontrolled air environment.

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 of heat exchanger tubes exposed to lubricating oil, stating that reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The charging and volume control system charging and safety injection pump gear oil cooler tubes have been aligned to this item based on material, environment, aging effect, and program. The applicant manages heat exchanger tubes exposed to lubricating oil with the Lubricating Oil Analysis Program in combination with the One-Time Inspection Program. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to reduction of heat transfer due to fouling. One-Time Inspection Program inspections either verify that no unacceptable

degradation has occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

SRP-LR Section 3.2.2.2.4 and GALL Report, Volume 1, Table 2, AMR Item 9, state 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 discussion column of Table 3.2.1, item 3.2.1-09, states that the AMPs credited to manage reduction of heat transfer due to fouling of steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil are the Lubricating Oil Analysis Program and the One-Time Inspection Program. The staff verified that engineered safety feature systems have no stainless steel heat exchanger tubes exposed to lubricating oil within the scope of license renewal, that the engineered safety feature components that align to AMR item 3.2.1-09 are the charging and safety-injection pump gear oil cooler tubes made of copper alloy containing less 15-percent alloying zinc, and that the AMR item to manage reduction of heat transfer of these tubes exposed to the lubricating oil environments is in LRA Table 3.3.2-1. The staff determined that, in this AMR item, the applicant credits both the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage this aging effect consistent the recommendations of SRP-LR Section 3.2.2.2.4 and GALL Report, Volume 1, Table 2, AMR Item 9. The staff's evaluations of the applicant's Lubricating Oil analysis Program and One-Time Inspection Program are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. On these bases, the staff finds the Lubricating Oil Analysis Program and One-Time Inspection Programs adequate to manage reduction of heat transfer due to fouling for CVCS CSIP gear oil cooler tubes.

Based on this review, the staff concludes that the AMR to manage reduction of heat transfer due to fouling of the CSIP gear oil cooler tubes is consistent with the staff's recommended position in SRP-LR Section 3.2.2.2.4 and GALL Report, Volume 1, Table 2, AMR Item 9, and acceptable.

(2) LRA Section 3.2.2.2.4 addresses reduction of heat transfer due to fouling of heat exchanger tubes exposed to treated water, stating that the Water Chemistry Program together with the One-Time Inspection Program manage reduction of heat transfer due to fouling for the residual heat removal heat exchanger and seal water cooler tubes. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to mitigate or reduce heat transfer due to fouling. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

SRP-LR Section 3.2.2.2.4 and GALL Report, Volume 1, Table 2, Item 10, state 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 discussion column of Table 3.2.1, item 3.2.1-10, states that HNP manages reduction of heat transfer due to fouling with a combination of the Water Chemistry Program and the One-Time Inspection Program consistent with the GALL Report.

The staff reviewed the Water Chemistry Program, which monitors chlorides, fluorides, and dissolved oxygen to limit the contaminants, minimize occurrences of aging effects, and maintain component ability to perform intended functions. The staff also reviewed the One-Time Inspection Program and verified that the program's one-time inspection of stainless steel heat exchanger tube components exposed to treated water manages reduction of heat transfer due to fouling of the surfaces of the tubes exposed to treated water. The staff's evaluations of the Water Chemistry Program and the One-Time Inspection Program are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively. The staff finds these programs consistent with GALL Report recommendations and adequate to manage loss of material due to pitting and crevice corrosion on internal surfaces of stainless steel low-head safety-injection and residual heat removal system heat exchanger tubes exposed to treated water.

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 in a BWR standby gas treatment system, stating that this aging effect does not apply to HNP, a PWR plant.

SRP-LR Section 3.2.2.2.5 and GALL Report, Volume 1, Table 2, AMR Item 11, state 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.

This further evaluation item does not apply to HNP, a PWR plant.

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, stating that such loss of material could occur in the stainless steel high-pressure safety injection (HPSI) pump mini-flow recirculation orifices exposed to treated borated water. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages loss of material due to erosion of the stainless steel HPSI pump miniflow recirculation orifices by visual inspections for environmental conditions causing material degradation that could result in loss of component intended functions.

SRP-LR Section 3.2.2.2.6 and GALL Report, Volume 1, Table 2, Item 12, state that loss of material due to erosion may occur in the stainless steel HPSI pump miniflow recirculation orifice exposed to treated borated water. The GALL Report recommends that plant-specific AMPs be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. The GALL Report references Licensee Event Report 50-275/94-023 as operating experience with erosion events in HPSI pump mini-flow recirculation orifices. Further evaluation is recommended to ensure that the aging effect is adequately managed.

The discussion column of Table 3.2.1, item 3.2.1-12, credits a plant-specific AMP to manage loss of material due to erosion of stainless steel HPSI (charging) pump miniflow orifices exposed to treated borated water. Specifically, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages these CVCS components. The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The staff verified that the applicant included the AMR line item for loss of material due to erosion of the stainless steel HPSI (charging) pump miniflow orifices in LRA Section 3.3.2.1.1 and LRA Table 3.3.2-1. The staff also verified that the AMR in LRA Table 3.3.2-1 credits the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect.

Based on the programs credited to manage this aging effect, the staff concludes that the applicant has credited an appropriate AMP to manage reduction of heat transfer capability in HPSI pump mini-flow recirculation orifices and that the applicant's AMR is consistent with the recommended staff position in SRP-LR Section 3.2.2.2.6 and in GALL Report, Volume 1, Table 2, Item 12.

On these bases for this AMR item, 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).

3.2.2.2.7 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, stating that this aging effect does not apply to HNP, a PWR plant.

SRP-LR Section 3.2.2.2.7 and GALL Report, Volume 1, Table 2, Item 13, state that loss of material due to general corrosion and fouling may occur in BWR 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 further evaluation item does not apply to HNP, a PWR plant.

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 exposed to treated water, stating that this aging effect does not apply to HNP, a PWR plant.

SRP-LR Section 3.2.2.2.8 and GALL Report, Volume 1, Table 2, Item 14, 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.

This further evaluation item does not apply to HNP, a PWR plant.

(2) LRA Section 3.2.2.2.8 addresses loss of material due to general, pitting, and crevice corrosion in internal surfaces of containment isolation components, stating that such loss of material is possible for internal surfaces of containment isolation piping, piping components, and piping elements exposed to treated water. The applicant evaluates these internal surfaces with their parent systems and credits an appropriate AMP if loss of material due to pitting and crevice corrosion occurs.

SRP-LR Section 3.2.2.2.8 and GALL Report, Volume 1, Table 2, Item 15, 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.

The discussion column of LRA Table 3.2.1, item 3.2.1-15, states that loss of material due to general, pitting, and crevice corrosion in steel containment isolation piping, piping component, and piping element internal surfaces exposed to treated water is an AERM.

The staff informed the applicant that the steel containment isolation piping and piping components discussed in LRA Table 3.2.1, AMR Item 3.2.1-15, should have been directly aligned to GALL Report, Volume 1, Table 2, AMR Item 15, and to GALL Report, Volume 2, Table V.C, AMR Item V.C-6.

The staff's review of LRA Section 3.2.2.2.8 identified an area in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.2-1, Part C, dated January 7, 2008, the staff asked the applicant to provide its basis for why the Type 2 Table AMRs for those steel containment isolation piping, piping components, and piping elements evaluated in LRA AMR Item 3.2.1-15 have not been aligned to GALL AMR Item V.C-6. Specifically, the staff asked the applicant to provide its basis for why the further evaluation basis for these AMRs, as given in LRA AMR Item 3.2.1-15 and in LRA Section 3.2.2.2.8.2, have not credited both the One-Time Inspection Program and the Water Chemistry Program to manage loss of material due to general, pitting, and crevice corrosion in the surfaces of the containment isolation piping, piping components, and piping elements that are exposed to a treated water environment.

In its response dated January 17, 2008, the applicant clarified that there are not any AMR line items in the LRA that align to GALL AMR Item V.C-6 because there are not any containment isolation piping, piping components, or piping element that are made from carbon steel, other than the carbon steel nitrogen supply piping (including its containment isolation portions). For this piping line, the applicant clarified that the internal environment is that for dry nitrogen gas, which is different from the treated water environment that, if present, could induced the aging effects discussed in GALL AMR Item V.C-6. Dry nitrogen gas is an inert dry gaseous environment. This environment does not create opportunities for water condensation on the internal surfaces of the components exposed to the nitrogen environment and does not create an atmospheric environment that is conducive to the initiation of corrosion (i.e. the dry nitrogen gas creates an inerted condition for carbon steel surfaces that are in contact with it).

Thus, based on the applicant's response, the staff concludes that SRP-LR Section 3.2.2.2.8, Item 20 and GALL AMR Item V.C-6, dealing with managing loss of material in carbon steel containment isolation piping, piping components, or piping elements under internal exposure to treated water, are not applicable to the design of the HNP containment isolation piping, piping components, and piping elements because:

(a) there are not any containment isolation piping, piping components, or piping elements that are made from carbon steel, other than the carbon steel nitrogen supply piping (including its containment isolation portions) and those containment isolation components that are exposed to a treated water environment are fabricated from austenitic stainless steel

(b) the environment for the internal surfaces of the carbon steel nitrogen supply piping (including its containment isolation portions) is that of dry nitrogen gas, which creates an inert environment for carbon steel materials

Based on its review, the staff finds the applicant's response to RAI 3.2-1, Part C, acceptable because the applicant demonstrated a valid basis for using the Water Chemistry Program as the basis for managing loss of material due to pitting and crevice corrosion in the stainless steel containment isolation components that are exposed to treated water and for stating that there are no AERMs for the carbon steel nitrogen supply containment isolation component that are exposed internally to a dry nitrogen gas environment. The staff's concern described in RAI 3.2-1, Part C, is resolved with respect to aging management of these contain isolation components.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.1. The staff finds that this program includes activities that are consistent with recommendations in the GALL Report, and are adequate to manage loss of material in the components.

(3) LRA Section 3.2.2.2.8 addresses loss of material due to general, pitting, and crevice corrosion in steel piping components exposed to lubricating oil, stating that such loss of material could occur for steel piping, piping components, and piping elements exposed to lubricating oil. Although the engineered safety feature systems have no steel piping components exposed to lubricating oil, a combination of the Lubricating Oil Analysis and One-Time Inspection Programs manages loss of material for the reactor coolant pump oil cooler/heat exchanger components exposed to lubricating oil. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

SRP-LR Section 3.2.2.2.8 and GALL Report, Volume 1, Table 2, Item 16, state 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 discussion column of Table 3.2.1, item 3.2.1-16, states that the AMPs credited to manage loss of material due to general, pitting, and crevice corrosion of steel containment isolation piping, piping components, and piping elements exposed to lubricating oil are the Lubricating Oil Analysis Program and the One-Time Inspection Program. The staff's evaluations of the applicant's Lubricating Oil analysis Program and One-Time Inspection Program are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. The staff finds these programs consistent with GALL Report recommendations and adequate to manage loss of material due to general, pitting, and crevice corrosion; however, the applicant stated that although the engineered safety feature systems have no steel piping components exposed to lubricating oil, HNP manages RCP oil cooler/heat exchanger components with a combination of the Lubricating Oil Analysis Program and the One-Time Inspection Program. The staff verified that engineered safety feature systems have no steel piping components exposed to lubricating oil; therefore, the staff agrees that this item does not apply to HNP engineered safety feature systems.

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, stating that this aging effect is not present because the engineered safety feature systems have no piping components exposed to soil.

SRP-LR Section 3.2.2.2.9 and GALL Report, Volume 1, Table 2, Item 17, state 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.

The discussion column of Table 3.2.1, item 3.2.1-17, states that this item does not apply because the engineered safety feature systems have no steel piping, piping components, or piping elements exposed to soil.

Based on the review of the LRA and the applicant's supporting documents, the staff verified that the engineered safety feature systems have no piping components exposed to soil within the scope of license renewal; therefore, the staff agrees that this item does not apply to HNP engineered safety feature systems.

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 3.2.2-4, 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 3.2.2-4, 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 Engineered Safety Features - Summary of Aging Management Evaluation - Containment Spray 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 containment spray system component groups.

LRA Table 3.2.2-1 includes plant-specific AMRs (as designated with annotated Note F) for stainless steel closure bolting in the containment spray system exposed to air-indoor and air-outdoor environments. In these AMRs, the applicant credited the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening in the bolting.

The staff reviewed the GALL Report and verified that it includes no AMR for these material, component, environment, and aging effect combinations. The staff also verified that the applicant's Bolting Integrity Program is consistent with the program elements of GALL AMP XI.M.18, "Bolting Integrity Program," and that program inspections monitor loss of preload, bolt loosening, and good bolting practices, which include guidelines for proper disassembly, inspection, and reassembly of connections with threaded fasteners. On the basis of this review, the staff concludes that it is valid to credit the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening in the containment spray system for stainless steel closure bolting exposed to the air-indoor and air-outdoor environments. The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5.

LRA Table 3.2.2-1 includes plant-specific AMRs (as designated with annotated Note G) for stainless steel piping, piping components, and piping elements and for stainless steel refueling water storage tanks in the containment spray system exposed to air-outdoor environments. The applicant did not credit any AMPs for these component, material, and environment combinations because it concluded that there are no AERMs for stainless steel piping components and or other stainless steel components exposed to uncontrolled air-outdoor environments.

The staff verified that, although the GALL Report does not include AMR items on aging of stainless steel components exposed to an air-outdoor environments, the GALL Report does include AMR Item V.F-12 with an AMR for stainless steel piping components exposed to external air-indoor environments and the position that there are no AERMs for stainless steel components exposed to such environments. The staff verified that no operating experience implies that stainless steel component surfaces exposed to uncontrolled, air-outdoor environments have AERMs; thus, the staff finds it valid to conclude that there are no AERMs for surfaces of stainless steel piping, piping components, piping elements, and refueling water storage tanks exposed to air - outdoor environments. Based on this finding, the staff concludes that the applicant need not credit any AMPs for these component, environment, material, and aging effect combinations.

LRA Table 3.2.2-1 includes a plant-specific AMR (as designated with annotated Note H) on loss of material due to general, pitting, or crevice corrosion in steel (*i.e.*, carbon or low-alloy steel) piping, piping components, and piping elements of the containment spray system exposed to air or gas (wetted inside) environments. In this AMR, the applicant credited the One-Time Inspection Program to manage loss of component material.

The staff verified that, although the GALL Report does not include any AMR items on aging of steel piping, piping components, or piping elements exposed to air or gas (wetted inside) environments, the GALL Report does include AMR Item V.A-19 with an AMR for steel piping components exposed to air-indoor uncontrolled environments recommending GALL AMP XI.M38, "Inspection of Internals Surfaces in Miscellaneous Piping and Ducting Components," to manage loss of material due to general, pitting, or crevice corrosion in steel piping components exposed to air-indoor uncontrolled environments. The staff asked the applicant to for a technical basis for crediting the One-Time Inspection Program to manage this aging effect.

In its response dated August 20, 2007, the applicant clarified that the gaseous atmosphere for these steel piping, piping components and piping elements is inerted with nitrogen gas, and that in this environment corrosion is unlikely. In addition, the applicant stated that its Water Chemistry Program both monitors and controls water chemistry using site procedures and processes, including the process to monitor and sample the containment atmosphere to ensure its inertion with an acceptable level of nitrogen gas during normal plant operations, to prevent or mitigate the loss of material aging effect.

A containment atmosphere maintained with nitrogen gas during normal plant operations creates an inert environment that precludes the initiation of corrosive aging mechanisms in the external piping surfaces; thus, the staff concludes that loss of material due to general, pitting, or crevice corrosion is not likely to occur in components exposed to nitrogen environments and that the applicant's One-Time Inspection Program is proper to credit for confirmation that loss of material has not occurred in the piping components. In addition, it is valid to couple the One-Time Inspection Program with the applicant's Water Chemistry Program because that program will ensure maintenance of an appropriate level of nitrogen in the containment during normal plant operations. Based on this review, the staff concludes that it is valid to credit the Water Chemistry Program and the One-Time Inspection Program to manage loss of material due to general, pitting, and crevice corrosion in these steel piping components exposed to the air or gas (wetted inside) environments. The staff's evaluations of the applicant's Water Chemistry Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively.

LRA Table 3.2.2-1 includes a plant-specific AMR (as annotated by Note J) for piping insulation in the containment spray system exposed to air-indoor environments. This AMR concludes that there are no AERMs for piping insulation for the containment spray system exposed to air-indoor environments.

The staff reviewed the GALL Report and verified that it includes no AMR item for this component, material, and environment combination. The staff also verified that there is no plant-specific or industry operating experience that would invalidate the applicant's conclusion that the piping insulation is not subject to any AERM. On the basis of this review, the staff concludes that the piping insulation in the containment spray system is not subject to any AERM and that the applicant need not credit any AMP to manage the piping insulation.

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 Engineered Safety Features - Summary of Aging Management Evaluation - High Head Safety Injection System - LRA Table 3.2.2-2

The staff reviewed LRA Table 3.2.2-2, which summarizes the results of AMR evaluations for the high-head safety-injection system component groups.

LRA Table 3.2.2-2 includes a plant-specific AMR (as designated with annotated Note F) for stainless steel closure bolting in the high-head safety-injection system exposed to air-indoor environments. In this AMR, the applicant credited the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening in the bolting.

The staff reviewed the GALL Report and verified that it includes no AMR for this material, component, environment and aging effect combination. The staff also verified that the applicant's Bolting Integrity Program is consistent with the program elements of GALL AMP XI.M.18, "Bolting Integrity Program," and that program inspections monitor loss of preload, bolt loosening, and good bolting practices, which include guidelines for proper disassembly, inspection, and reassembly of connections with threaded fasteners. On the basis of this review, the staff concludes that it is valid to credit the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening in the high-head safety-injection system stainless steel closure bolting exposed to air-indoor environments. The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5.

LRA Table 3.2.2-2 shows a plant-specific AMR (as annotated by Note J) for piping insulation in the high-head safety-injection system exposed to air-indoor environments. In this AMR, the applicant concluded that there are no AERMs for the high-head safety-injection system piping insulation exposed to air-indoor environments.

The staff reviewed the GALL Report and verified that it includes no AMR item for this component, material, and environment combination. The staff also verified that there is no plant-specific or industry operating experience that would invalidate the applicant's conclusion that the piping insulation is not subject to applicable AERMs. On the basis of this review, the staff concludes that the piping insulation in the high-head safety-injection system is not subject to any applicable AERMs and that the applicant need not credit any AMPs to manage the piping insulation.

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 Engineered Safety Features - Summary of Aging Management Evaluation - Low Head Safety Injection System and Residual Heat Removal 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 low head safety injection system and residual heat removal system component groups.

LRA Table 3.2.2-3 includes a plant-specific AMR (as designated with annotated Note F) for stainless steel closure bolting in the low head safety injection and residual heat removal system under exposure to the air-indoor (outside) environment. In this AMR, the applicant credited the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening in the bolting.

The staff reviewed the GALL Report and verified that it includes no AMR for this material, component, environment and aging effect combination. The staff also verified that the applicant's Bolting Integrity Program is a program is consistent with the program elements of GALL AMP XI.M.18, "Bolting Integrity Program," and that program inspections monitor loss of preload and bolt loosening and good bolting practices, which include for proper disassembly, inspection, and reassembly of connections with threaded fasteners. On the basis of this review, the staff concludes that it is valid to credit the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening in the low head safety injection and residual heat removal system stainless steel closure bolting exposed to the air-indoor (outside) external environments. The staff evaluation of the Bolting Integrity Program is documented in Section 3.0.3.2.5.

In LRA Table 3.2.2-3, the applicant provided a plant-specific AMR (as annotated by Note J) for piping insulation in the low head safety injection and residual heat removal system exposed to an air-indoor (outside) environments. In this AMR, the applicant concluded that there are no AERMs for the low head safety injection and residual heat removal system piping insulation exposed to an air-indoor (outside) environments.

The staff reviewed the GALL Report and verified that it includes no AMR item for this component, material, and environment combination. The staff also verified that there is no plant-specific or industry operating experience that would invalidate the applicant's conclusion that the piping insulation is not subject to any AERM. On the basis of this review, the staff concludes that the piping insulation in the low-head safety-injection and residual heat removal systems is not subject to any AERM and that the applicant need not credit any AMP to manage it.

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 Engineered Safety Features - Summary of Aging Management Evaluation - Passive Safety 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 passive safety injection system component groups.

LRA Table 3.2.2-3 includes a plant-specific AMR (as designated with annotated Note F) for stainless steel closure bolting in the passive safety-injection system exposed to air-indoor environments. In this AMR, the applicant credited the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening in the bolting.

The staff reviewed the GALL Report and verified that it includes no AMR for this material, component, environment, and aging effect combination. The staff also verified that the applicant's Bolting Integrity Program is consistent with the program elements of GALL AMP XI.M.18, "Bolting Integrity Program," and that program inspections monitor loss of preload, bolt loosening, and good bolting practices, which include guidelines for proper disassembly, inspection, and reassembly of connections with threaded fasteners. On the basis of this review, the staff concludes that it is valid to credit the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening in the passive safety-injection system stainless steel closure bolting exposed to air-indoor environments. The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5.

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 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).

3.3 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:

- chemical and volume control system (CVCS)
- boron thermal regeneration system
- primary makeup system
- primary sampling system
- post-accident sampling system
- circulating water system
- cooling tower system
- cooling tower make-up system
- screen wash system
- main reservoir auxiliary equipment
- auxiliary reservoir auxiliary equipment
- normal service water system
- emergency service water system
- component cooling water system
- waste processing building cooling water system
- essential services chilled water system
- non-essential services chilled water system
- emergency screen wash system
- generator gas system
- hydrogen seal oil system
- emergency diesel generator system

- diesel generator fuel oil storage and transfer system
- diesel generator lubrication system
- diesel generator cooling water system
- diesel generator air starting system
- security power system
- instrument air system
- service air system
- bulk nitrogen storage system
- hydrogen gas system
- fire protection system
- storm drains system
- oily drains system
- radioactive floor drains system
- radioactive equipment drains system
- secondary waste system
- laundry and hot shower system
- upflow filter system
- potable and sanitary water system
- demineralized water system
- filter backwash system
- radiation monitoring system
- oily waste collection and separation system
- liquid waste processing system
- secondary waste treatment system
- boron recycle system
- gaseous waste processing system
- radwaste sampling system
- refueling system
- new fuel handling system
- spent fuel system
- spent fuel pool cooling system
- spent fuel pool cleanup system
- spent fuel cask decontamination and spray system
- spent resin storage and transfer system
- containment auxiliary equipment
- containment liner penetration auxiliary equipment
- security building heating, ventilating, and air conditioning (HVAC) system
- containment vacuum relief system
- bridge crane equipment
- containment pressurization system
- penetration pressurization system
- containment cooling system

- airborne radioactivity removal system
- containment atmosphere purge exhaust system
- control rod drive mechanism ventilation system
- primary shield and reactor supports cooling system
- fuel cask handling crane system
- reactor auxiliary building ventilation system
- emergency service water intake structure ventilation system
- turbine building area ventilation system
- waste processing building HVAC system
- diesel generator building ventilation system
- fuel oil transfer pump house ventilation system
- fuel handling building auxiliary equipment
- fuel handling building HVAC system
- turbine building health physics room auxiliary equipment
- polar crane auxiliary equipment
- elevator system
- technical support center HVAC system
- mechanical components in electrical systems
- monorail hoists equipment
- post-accident hydrogen system

3.3.1 Summary of Technical Information in the Application

LRA Section 3.3 provides the applicant's AMR results for the auxiliary systems components and component groups. LRA Table 3.3.1, "Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems," 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 operating experience 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 operating experience included a review of the GALL Report and operating experience 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 operating experience 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 System Components in the GALL Report

Not used
Not used (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 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 SRP-LR Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1)	Yes	TLAA	Fatigue is a TLAA (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	Fatigue is a 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 to PWRs (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 stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.3)
Stainless steel and stainless clad steel heat exchanger components exposed to treated water > 60°C (> 140°F) (3.3.1-5)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.3)
Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-6)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.3)

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 non-regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-7)	Cracking due to stress corrosion cracking 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	Water Chemistry Program (B.2.2); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.4)
Stainless steel regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-8)	Cracking due to stress corrosion cracking 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 stress corrosion cracking and cyclic loading. A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry Program (B.2.2); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.4)
Stainless steel high-pressure pump casing in PWR chemical and volume control system (3.3.1-9)	Cracking due to stress corrosion cracking 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 stress corrosion cracking and cyclic loading. A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry Program (B.2.2); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.4)

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
High-strength steel closure bolting exposed to air with steam or water leakage. (3.3.1-10)	Cracking due to stress corrosion cracking, 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 (See SER Section 3.3.2.2.4)
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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24); External Surfaces Monitoring Program (B.2.22)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.5)
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	Not applicable (See SER Section 3.3.2.2.5)
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-absorbin g capacity and loss of material due to general corrosion	A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry Program (B.2.2)	Consistent with GALL Report, which recommends further evaluation (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.2.25); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.7)

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 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	Lubricating Oil Analysis Program (B.2.25); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.7)
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	Lubricating Oil Analysis Program (B.2.25); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.7)
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	Not applicable	Not applicable (See SER Section 3.3.2.2.7)
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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.7)
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 microbiologically influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Buried Piping and Tanks Inspection Program (B.2.20)	Consistent with GALL Report, which recommends further evaluation (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 microbiologically influenced corrosion, and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry Program (B.2.16); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.9)

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 (3.3.1-21)	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program (B.2.25); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.9)
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	Not applicable (See SER Section 3.3.2.2.10)
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	Not applicable	Not applicable to PWRs
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	Not applicable	Not applicable (See SER Section 3.3.2.2.10)
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	Not applicable	Not applicable (See SER Section 3.3.2.2.10)
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.2.25); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)

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 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	External Surfaces Monitoring Program (B.2.22)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)
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	Fire Water System Program (B.2.15); Selective Leaching of Materials Program (B.2.19)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)
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	Not applicable (See SER Section 3.3.2.2.10)
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	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.10)
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	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.11)

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, 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 microbiologically influenced corrosion	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry Program (B.2.16); One-Time Inspection Program (B.2.18); Fire Protection Program (B2.14)* (*with Fuel Oil Chemistry Program applicable to diesel-driven fire pump fuel oil supply line only)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.12)
Stainless steel piping, piping components, and piping elements exposed to lubricating oil (3.3.1-33)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program (B.2.25); One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.12)
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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24); External Surfaces Monitoring Program (B.2.22)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.13)

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 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 (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	Boraflex Monitoring Program (B.2.12)	Consistent with GALL Report (See SER Section 3.3.2.1)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-37)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	BWR Reactor Water Cleanup System	No	Not applicable	Not applicable to PWRs
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-38)	Cracking due to stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel BWR spent fuel storage racks exposed to treated water > 60°C (> 140°F) (3.3.1-39)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable	Not applicable (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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.11)

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
High-strength steel closure bolting exposed to air with steam or water leakage (3.3.1-41)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable	Not applicable (See SER Section 3.3.2.1.1)
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	Not used	Not used (See SER Section 3.3.2.1.1)
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.2.8)	Consistent with GALL Report (See SER Section 3.3.2.1)
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	Not used	Not used (See SER Section 3.3.2.1.1)
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.2.8)	Consistent with GALL Report (See SER Section 3.3.2.1)
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 stress corrosion cracking	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program (B.2.11)	Consistent with GALL Report (See SER Section 3.3.2.1)
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-Cycle Cooling Water System Program (B.2.11)	Consistent with GALL Report (See SER Section 3.3.2.1)

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 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-Cycle Cooling Water System Program (B.2.11); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.12)
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 microbiologically influenced corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to PWRs
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-Cycle Cooling Water System Program (B.2.11); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.13)
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-Cycle Cooling Water System Program (B.2.11)	Consistent with GALL Report (See SER Section 3.3.2.1)

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, 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	Closed-Cycle Cooling Water System Program (B.2.11)	Consistent with GALL Report (See SER Section 3.3.2.1)
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	Not applicable	Not applicable (See SER Section 3.3.2.1.1)
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	Not used	Not used (See SER Section 3.3.2.1.1)
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	Not used	Not used (See SER Section 3.3.2.1.1)
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	Not used	Not used (See SER Section 3.3.2.1.1)
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	Not used	Not used (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 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	Not used	Not used (See SER Section 3.3.2.1.1)
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	External Surfaces Monitoring Program (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1)
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	External Surfaces Monitoring Program (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1)
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 Program (B2.14)	Consistent with GALL Report (See SER Section 3.3.2.1.14)
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	Fire Water System Program (B2.15)	Consistent with GALL Report (See SER Section 3.3.2.1.15)
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 Program (B2.14); Structures Monitoring Program (B.2.31)	Consistent with GALL Report (See SER Section 3.3.2.1.16)

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 fuel oil (3.3.1-64)	Loss of material due to general, pitting, and crevice corrosion	Fire Protection and Fuel Oil Chemistry	No	Fire Protection Program (B.2.14); Fuel Oil Chemistry Program (B.2.16)	Consistent with GALL Report (See SER Section 3.3.2.1)
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	Fire Protection Program (B2.14); Structures Monitoring Program (B.2.31); ASME Section XI, Subsection IWL Program (B.2.27)	Consistent with GALL Report (See SER Section 3.3.2.1.17)
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	Fire Protection Program (B2.14); Structures Monitoring Program (B.2.31); ASME Section XI, Subsection IWL Program (B.2.27)	Consistent with GALL Report (See SER Section 3.3.2.1.18)
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	Fire Protection Program (B2.14); Structures Monitoring Program (B.2.31); ASME Section XI, Subsection IWL Program (B.2.27)	Consistent with GALL Report (See SER Section 3.3.2.1.19)

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 raw water (3.3.1-68)	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Fire Water System	No	Fire Water System Program (B2.15); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.20)
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 (B2.15); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.21)
Copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-70)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling	Fire Water System	No	Fire Water System Program (B2.15); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.22)

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 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	Fuel Oil Chemistry Program (B.2.16); One-Time Inspection Program (B.2.18); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.23)
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) microbiologically influenced corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Fuel Oil Chemistry Program (B.2.16); One-Time Inspection Program (B.2.18); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.24)
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	Inspection of Overhead Heavy Load and Light Load Handling Systems Program (B.2.13)	Consistent with GALL Report (See SER Section 3.3.2.1)
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	Inspection of Overhead Heavy Load and Light Load Handling Systems Program (B.2.13)	Consistent with GALL Report (See SER Section 3.3.2.1)

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
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	Not applicable (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 microbiologically influenced corrosion, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program (B.2.10); One-Time Inspection Program (B.2.18); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24); External Surfaces Monitoring Program (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.25)
Steel heat exchanger components exposed to raw water (3.3.1-77)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program (B.2.10); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.26)
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	Not used	Not used (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 raw water (3.3.1-79)	Loss of material due to pitting and crevice corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program (B.2.10); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.27)
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 microbiologically influenced corrosion	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program (B.2.10); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.28)
Copper alloy piping, piping components, and piping elements, exposed to raw water (3.3.1-81)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program (B.2.10); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.29)

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 heat exchanger components exposed to raw water (3.3.1-82)	Loss of material due to pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program (B.2.10); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.30)
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	Open-Cycle Cooling Water System Program (B.2.10)	Consistent with GALL Report (See SER Section 3.3.2.1)
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 of Materials Program (B.2.19)	Consistent with GALL Report (See SER Section 3.3.2.1)
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 of Materials Program (B.2.19)	Consistent with GALL Report (See SER Section 3.3.2.1)
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 (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
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	Boraflex Monitoring Program (B.2.12)	Consistent with GALL Report (See SER Section 3.3.2.1)
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	Boric Acid Corrosion Program (B.2.4)	Consistent with GALL Report (See SER Section 3.3.2.1)
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	Boric Acid Corrosion Program (B.2.4)	Consistent with GALL Report (See SER Section 3.3.2.1.31)
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 stress corrosion cracking	Water Chemistry	No	Water Chemistry Program (B.2.2); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.32)
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	Water Chemistry Program (B.2.2); Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.24)	Consistent with GALL Report (See SER Section 3.3.2.1.33)

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 piping, piping components, and piping elements exposed to air - indoor uncontrolled (3.3.1-92)	None	None	No	None	Consistent with GALL Report (See SER Section 3.3.2.1)
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 (See SER Section 3.3.2.1)
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 (See SER Section 3.3.2.1)
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 (See SER Section 3.3.2.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.3.1-96)	None	None	No	None	Consistent with GALL Report (See SER Section 3.3.2.1)
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 (See SER Section 3.3.2.1)

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, 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 (See SER Section 3.3.2.1)
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	None	Consistent with GALL Report (See SER Section 3.3.2.1)

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

In LRA Section 3.3.2.1 the applicant identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- Water Chemistry Program
- Boric Acid Corrosion Program
- Flow-Accelerated Corrosion Program
- Bolting Integrity Program
- Open-Cycle Cooling Water System Program
- Closed-Cycle Cooling Water System Program
- Fire Protection Program
- Fire Water System Program
- Fuel Oil Chemistry Program
- One-Time Inspection Program

- Selective Leaching of Materials Program
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program

LRA Tables 3.3.2-1 through 3.3.2-71 summarize AMRs for the auxiliary systems components and indicate AMRs claimed by the applicant 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's evaluation follows.

3.3.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.3.1 shows items 39, 41, 53, and 75 as "Not Applicable" as the component, material, and environment combination is not present. For each of these line items, the staff reviewed the LRA and the applicant's supporting license renewal basis calculations and confirmed the applicant's claim that the component, material, and environment combination is not present at HNP. On the basis that HNP has no component, material, and environment combination for these Table 1 line items, the staff finds that these AMRs do not apply.

LRA Table 3.3.1 shows items 42, 44, 54, 55, 56, 57, 58, and 78 as "not used" as the component, material, and environment combination is addressed by another Table 1 line item. For each of these line items, the staff reviewed the LRA and license renewal basis calculations and confirmed that the line item is not used in the LRA. In addition, the staff confirmed that the aging effects addressed by these line items are addressed by other appropriate Table 1 AMR line items. On this basis, the staff finds the applicant's treatment of these Table 1 AMR line items as "not used" acceptable.

3.3.2.1.2 Cracking Due to Stress Corrosion Cracking

LRA Table 3.3.1, item 3.3.1-06, states that SCC of the stainless steel expansion joint exposed to diesel exhaust is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. During the audit and review, the staff noted that the AMR result item referring to LRA Table 3.3.1, item 3.3.1-06, refers to Note E.

The staff reviewed the AMR result item referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends a plant-specific AMP, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff's evaluation of that program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program periodically inspects internal surfaces of piping, piping elements, ducting, and components visually for timely detection of component degradation. On the basis of periodic visual inspections, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable.

On the bases of its review of the AMR result item and its comparison of the applicant's results to the corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.3 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

LRA Table 3.3.1, item 3.3.1-07, states that cracking of CVCS heat exchanger components exposed to treated water is managed by a combination of the Water Chemistry and the One-Time Inspection Programs. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-07, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report, which recommends a combination of GALL AMP XI.M2, "Water Chemistry," and a plant-specific verification program. The applicant proposed the Water Chemistry Program, which is consistent with GALL AMP XI.M2, with the One-Time Inspection Program for verification. The staff's evaluations of the Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively. The One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program. The staff confirmed CVCS inclusion within the scope of the One-Time Inspection Program for verification of the effectiveness of the Water Chemistry Program to manage cracking. On the basis of one-time visual inspections in the CVCS, the staff finds the applicant's One-Time Inspection Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.4 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

LRA Table 3.3.1, item 3.3.1-08, states that cracking of stainless steel regenerative heat exchanger components in the CVCS and the boron thermal regeneration system exposed to treated water is managed by a combination of the Water Chemistry and the One-Time Inspection Programs. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-08, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report, which recommends a combination of GALL AMP XI.M2, "Water Chemistry," and a plant-specific verification program. The applicant proposed the Water Chemistry Program, which is consistent with GALL AMP XI.M2, with the One-Time Inspection Program for verification. The staff's evaluations of the Water Chemistry and One-Time

Inspection Programs are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively. The One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program. The staff confirmed that the CVCS and the boron thermal regeneration system are within the scope of the One-Time Inspection Program for verification of the effectiveness of the Water Chemistry Program to manage cracking. On the basis of one-time visual inspections of these systems, the staff finds the applicant's One-Time Inspection Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.5 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

LRA Table 3.3.1, item 3.3.1-09, states that cracking of stainless steel CSIP casings in the CVCS exposed to treated water is managed by a combination of the Water Chemistry and the One-Time Inspection Programs. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-09, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report, which recommends a combination of GALL AMP XI.M2, "Water Chemistry," and a plant-specific verification program. The applicant proposed the Water Chemistry Program, which is consistent with GALL AMP XI.M2, with the One-Time Inspection Program for verification. The staff's evaluations of the Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively. The One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program. The staff confirmed CVCS inclusion within the scope of the One-Time Inspection Program for verification of the effectiveness of the Water Chemistry Program to manage cracking. On the basis of one-time visual inspections of the CVCS, the staff finds the applicant's One-Time Inspection Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.6 Hardening and Loss of Strength Due to Elastomer Degradation

LRA Table 3.3.1, item 3.3.1-11, states that hardening and loss of strength of elastomer seals and components in the auxiliary systems exposed to air-indoor is managed by either the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program or the External Surfaces Monitoring Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-11, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report. The GALL Report recommends a plant-specific program. The applicant proposed either the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program or the External Surfaces Monitoring Program to manage the aging effects. The External Surfaces Monitoring Program is for component types exposed to external air-indoor environments whereas the component types exposed to internal air-indoor environments are managed by the Internal Surfaces in Miscellaneous Piping and Ducting Program.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of the external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of the periodic visual inspections of external surfaces, the staff finds the applicant's External Surfaces Monitoring Program acceptable.

The staff's evaluation of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.1.7. The program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of the periodic inspections of components internal surfaces, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.7 Loss of Material/General (Steel Only), Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-18, states that loss of material of the stainless steel and steel diesel exhaust piping, piping components, and piping elements and diesel exhaust silencers exposed to diesel exhaust is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-18, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends a plant-specific AMP, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.1.7. The program periodically visually inspects the internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of periodic visual inspections, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.8 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-27, states that loss of material on containment purge system bird screens exposed to air-outdoor is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that two AMR result items referring to LRA Table 3.3.1, item 3.3.1-37 refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends evaluation of any plant-specific AMP, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant stated that Note E was appropriate because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is not plant-specific. During the onsite audit, the staff confirmed that the bird screens were actually inside the containment purge system ducting; therefore, the bird screen external environment was similar to that described in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff finds that this program would detect this aging effect or mechanism during periodic visual inspections of internal surfaces of component types within its scope. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.1.7. On this basis, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable for aging management of these HVAC components.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.9 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-32, states that loss of material of stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil (except for the diesel driven fire pump fuel oil supply line) is managed by the Fuel Oil Chemistry and One-Time Inspection Programs. During the audit and review, the staff noted that one AMR result item referring to LRA Table 3.3.1, item 3.3.1-32, refers to Note E.

The staff reviewed the AMR result item referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends the Fuel Oil Chemistry and One-Time Inspection Programs, the applicant proposed the Fire Protection and Fuel Oil Chemistry Programs; therefore, the applicant applied Note E for the diesel-driven fire pump fuel oil supply line. The staff's evaluations of the Fire Protection and Fuel Oil Chemistry Programs are documented in SER Sections 3.0.3.1.4 and 3.0.3.1.7, respectively. The Fuel Oil Chemistry

Program is consistent with the GALL Report recommendation. The Fire Protection Program manages aging of the diesel-driven fire pump fuel oil supply line and credited fire barrier assemblies including fire doors, penetration seals, fire wrap, barrier walls, barrier ceilings and floors, and seismic joint filler through periodic inspections. The effective Fire Protection Program will adequately manage cracking and loss of material. On this basis, the staff finds Fire Protection Program an adequate alternative to the One-Time Inspection Program for adequate management of aging effects for copper tubing exposed to fuel oil.

On the bases of its review of the AMR result item and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.10 Loss of Material Due to Wear

LRA Table 3.3.1, item 3.3.1-34, states that loss of material due to wear of elastomer seals and components exposed to external air-indoor environments is managed by the External Surfaces Monitoring Program or by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program if component types are exposed to internal air/gas (wetted) environments. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-34, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends a plant-specific program, the applicant proposed either the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program or the External Surfaces Monitoring Program to manage the aging effects. The External Surfaces Monitoring Program is for component types exposed to external air-indoor environments whereas component types exposed to internal air-indoor environments are managed by the Internal Surfaces in Miscellaneous Piping and Ducting Program.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of the external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of the periodic visual inspections of the external surfaces, the staff finds the applicant's External Surfaces Monitoring Program acceptable.

The staff's evaluation of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of the periodic inspections of component internal surfaces, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.11 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-40, states that loss of material of steel tank component (diesel-driven fire pump fuel oil storage tank flame arresters) external surfaces exposed to outdoor air environments is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that one AMR result item referring to LRA Table 3.3.1, item 3.3.1-40, refers to Note E.

The staff reviewed the AMR result item referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M29, "Above Ground Steel Tanks Program," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff asked the applicant to clarify how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages the external surfaces of this component.

In its response dated August 20, 2007, the applicant explained that external surfaces of the component flame arresters are adequately managed by the Inspection of Internal Surfaces in Miscellaneous and Ducting Components Program. Additionally, the applicant stated that maintenance on relatively small components like a flame arrester can observe the condition of external as well as internal surfaces adequately. The staff recognizes that, although the flame arresters are installed internally in the tank vents, the environment is outdoor air.

On the basis that flame arresters are subject to periodic maintenance and have been evaluated as exposed to outdoor air, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous and Ducting Components Program acceptable because the Above Ground Steel Tanks Program does not address these components but the Inspection of Internal Surfaces in Miscellaneous and Ducting Components Program addresses them.

On the bases of its review of the AMR result item and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.3.2.1.12 Loss of Material Due to Crevice, General, and Pitting Corrosion

LRA Table 3.3.1, item 3.3.1-48, states that loss of material of carbon or low-alloy steel and gray cast-iron components exposed to treated water either internally or externally is managed by the Inspection of Internal Surfaces in Miscellaneous and Ducting Components Program. During the audit and review, the staff noted that four AMR result items referring to LRA Table 3.3.1, item 3.3.1-48, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M20, "Closed-Cycle Cooling Water System," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the onsite audit, the staff confirmed that the components included within the radioactive equipment drains system are exposed various environments conservatively described as treated water. The treated water affecting these system components can be reactor-grade water from equipment leaks, drains, and tank overflows in various buildings. The treated water external environment affects components like floor drains that can be exposed to equipment drainage. The staff also confirmed that the external surfaces of component types managed by this Table 3.3.1 item are located within sumps and include pump casings, strainers, and discharge piping not accessible by external walkdowns. So management of external surfaces will be at the same time as for internal surfaces by periodic visual inspections under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

On the basis that carbon or low-alloy steel and gray cast-iron components in the radioactive equipment drains system exposed to treated water would be subject to periodic inspection and evaluation, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous and Ducting Components Program acceptable because aging effects for these components would be detected and prompt corrective action taken where required.

On the bases of its review of AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.3.2.1.13 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-50, states that loss of material of stainless steel system strainer screens/elements exposed to environments of treated water is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that one AMR result item referring to Table 3.3.1, item 3.3.1-50, refer to Note E.

The staff reviewed the AMR result item referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M21, "Closed-Cycle Cooling Water System," the applicant proposed Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The LRA states that Note E is to manage the aging effects of the system strainer screens/elements because these components are internal to the pump suction piping and the external environment of the screens is treated water. Further, the applicant explained that the Closed-Cycle Cooling Water System Program does not include stainless steel strainer screen/elements of this type and that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is more suitable for managing loss of material due to crevice and pitting corrosion.

On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program would detect and manage stainless steel system strainer screens/elements externally exposed to treated water and because these components are not within the Closed-Cycle Cooling Water System Program, the staff finds the Internal Surfaces Inspection of Miscellaneous Piping and Ducting Components Program acceptable.

On the bases of its review of the AMR result item and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.3.2.1.14 Increased Hardness, Shrinkage and Loss of Strength Due to Weathering

LRA Table 3.5.2-28 for elastomer seismic joint filler component types exposed to air-indoor environments refers to LRA Table 3.3.1, item 3.3.1-61, and GALL Report, items VII.G-1 and VII.G-2; however, only GALL Report, item VII.G-1, and not VII.G-2, is for air-indoor environments.

During the audit and review, the staff asked the applicant to explain why it referred to GALL Report item VII.G-2 for the environment for this result item.

In its response dated August 20, 2007, the applicant stated that it would amend the LRA to remove GALL Report item VII.G-2 from LRA Table 3.5.2-28 for elastomer seismic joint filler component types exposed to air-indoor environments. In the same August 20, 2007 letter, the applicant proposed the amendment to the AMR line item to remove GALL Report item VII.G-2. With this change, the staff finds the response consistent with the GALL Report and acceptable.

3.3.2.1.15 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-62, states that loss of material of aluminum or aluminum alloy heat exchanger components and aluminum or aluminum alloy piping, piping components, and piping elements exposed to internal environments of raw water is managed by the Fire Water System Program. During the audit and review, the staff noted that two AMR result items referring to LRA Table 3.3.1, item 3.3.1-62, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the material, environment, and aging effects are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M26, "Fire Protection," the applicant proposed the Fire Water System Program. The applicant explained the use of Note E for aluminum or aluminum alloy heat exchanger components and piping, piping components, and piping elements. For the aluminum or aluminum alloy heat exchanger components, the applicant stated that these are for the diesel-driven fire pump and that although the GALL Report recommends the Fire Protection Program, the Fire Water System Program is more effective because routine testing and inspection specified in the Fire Water System Program would adequately detect and manage aging effects for this component. For the aluminum or aluminum alloy piping, piping components, and piping elements, the applicant described them as for operation of the automatic sprinkler valves. Additionally, the applicant explained that the GALL Report recommends the Fire Protection Program but does not describe these components but the Fire Water System Program describes how loss of material for aluminum or aluminum alloy piping, piping components, and piping elements exposed to internal environments of raw water will be managed.

The staff's evaluation of the Fire Water System Program is documented in SER Section 3.0.3.2.11.

On the basis of its review of the Fire Water System Program, the staff finds that the applicant adequately explained the reasons for Note E to the two AMR result items and that for aluminum or aluminum alloy heat exchanger components and piping, piping components, and piping elements the Fire Water System Program would adequately detect and manage the aging effects of these components in raw water; therefore, the staff finds the Fire Water System Program for aluminum and aluminum heat exchanger components and piping, piping components, and piping elements acceptable.

On the bases of its review of AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.3.2.1.16 Loss of Material Due to Wear

LRA Table 3.3.1, item 3.3.1-63, states that loss of material of carbon steel fire-rated doors exposed to air-indoor and air-outdoor environments is managed by the Fire Protection and Structures Monitoring Programs. During the audit and review, the staff noted that 14 AMR result items referring to LRA Table 3.3.1, item 3.3.1-63, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the material, environment, and aging effects are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M26, "Fire Protection" and GALL AMP XI.S6, "Structures Monitoring," the applicant proposed the Fire Protection Program and the Structures Monitoring Program.

The applicant explained the use of Note E for carbon steel fire rated doors. The applicant explained that, although the GALL Report recommends the Fire Protection Program alone for management of the carbon steel fire-rated doors, the Structures Monitoring Program also ensures adequate management of the aging effects because the program has some of the program elements recommended by the GALL Report.

The staff's evaluations of the Fire Protection and Structures Monitoring Programs are documented in SER Sections 3.0.3.2.10 and 3.0.3.2.24, respectively.

On the basis of its review of the Fire Protection Program and the Structures Monitoring Program, the staff finds that the applicant adequately explained the reasons for Note E to the 12 AMR result items and that for carbon steel fire-rated doors the Fire Protection Program and the Structures Monitoring Program would adequately detect and manage aging effects for these components in indoor and outdoor air; therefore, the staff finds the Fire Protection Program and Structures Monitoring Program for carbon steel fire-rated doors acceptable.

On the bases of its review of AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.3.2.1.17 Concrete Cracking and Spalling Due to Aggressive Chemical Attack, and Reaction with Aggregates

LRA Table 3.3.1, item 3.3.1-65, states that concrete cracking and spalling due to aggressive environments and reaction with aggregates of reinforced concrete exposed to air-indoor environments in the containment building is managed by the Fire Protection and ASME Section XI, Subsection IWL Programs. During the audit and review, the staff noted that one AMR result item referring to LRA Table 3.3.1, item 3.3.1-65, refers to Note E.

The staff reviewed the AMR result item referring to Note E and determined that the material, environment, and aging effects are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M26, "Fire Protection" and GALL AMP XI.S6, "Structures Monitoring," the applicant proposed the Fire Protection Program and the ASME Section XI, Subsection IWL Program. The applicant explained the use of Note E for reinforced concrete fire barriers. Although the GALL Report recommends the Fire Protection Program and the Structures Monitoring Program for management of reinforced concrete in the containment building, the applicant uses the ASME Section XI, Subsection IWL Program in lieu of the Structures Monitoring Program because it is appropriate for reinforced concrete in containment to manage aging effects adequately because the ASME Section XI, Subsection IWL Program has some of the program elements recommended by the GALL Report.

The staff's evaluations of the Fire Protection and ASME Section XI, Subsection IWL Programs are documented in SER Sections 3.0.3.2.10 and 3.0.3.2.20, respectively.

On the basis of its review of the Fire Protection Program and the ASME Section XI, Subsection IWL Program, the staff finds that the applicant adequately explained the reasons for Note E to the AMR result item and that, for containment building reinforced concrete, the Fire Protection Program and the ASME Section XI, Subsection IWL Program would adequately detect and manage aging effects these components in indoor air; therefore, the staff finds the Fire Protection Program and ASME Section XI, Subsection IWL Program for containment reinforced concrete fire barriers acceptable.

On the bases of its review of the AMR result item and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.3.2.1.18 Concrete Cracking and Spalling Due to Freeze Thaw, Aggressive Chemical Attack, and Reaction with Aggregates

LRA Table 3.3.1, item 3.3.1-66, states that cracking of the reinforced concrete structural fire barriers (walls, ceilings and floors) exposed to air-outdoor environments is managed by a combination of the Fire Protection and ASME Section XI, Subsection IWL Programs for the containment cylinder wall. During the audit and review, the staff noted that the AMR result item referring to LRA Table 3.3.1, item 3.3.1-66, refers to Note E.

The staff reviewed the AMR result item referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends a combination of the Fire Protection and Structures Monitoring Programs, the applicant proposed a combination of the Fire Protection and ASME Section XI, Subsection IWL Programs. The applicant's existing Fire Protection Program will be consistent with GALL AMP XI.M26 following enhancement. The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.10. The ASME Section XI, Subsection IWL Program periodically visually inspects reinforced concrete containment structures. The staff's evaluation of the ASME Section XI, Subsection IWL Program is documented in SER Section 3.0.3.2.20. On the basis of periodic visual inspections, the staff finds the applicant's ASME Section XI, Subsection IWL Program acceptable.

On the bases of its review of the AMR result item and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.19 Loss of Material Due to Corrosion of Embedded Steel

LRA Table 3.3.1, item 3.3.1-67, states that the loss of material of the reinforced concrete structural fire barriers (walls, ceilings and floors) exposed to air-outdoor or uncontrolled air-indoor environments is managed by a combination of the Fire Protection and ASME Section XI, Subsection IWL Programs for the containment cylinder wall. During the audit and review, the staff noted that the two AMR result items referring to LRA Table 3.3.1, item 3.3.1-67, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends a combination of GALL AMP XI.M26, "Fire Protection," and GALL AMP XI.S6, "Structures Monitoring Program," the applicant proposed a combination of the Fire Protection and ASME Section XI, Subsection IWL Programs. The applicant's existing Fire Protection Program will be consistent with GALL AMP XI.M26 following enhancement. The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.10. The ASME Section XI, Subsection IWL Program periodically visually inspects reinforced concrete containment structures. The staff's evaluation of the ASME Section XI, Subsection IWL Program is documented in SER Section 3.0.3.2.20. On the basis of periodic visual inspections, the staff finds the applicant's ASME Section XI, Subsection IWL Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.20 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling

LRA Table 3.3.1, item 3.3.1-68, states that loss of material and fouling of steel piping, piping components, piping elements, and tanks and fuel handling building decontamination transfer pump casings exposed to raw water is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program for various drain and waste collection systems. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-68, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends the Fire Water System Program, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage the aging effect for various drain and collection systems. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program periodically visually inspects internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. During the audit and review, the staff confirmed that LRA Table 3.3.1, item 3.3.1-68, was for steel component types exposed to raw water in drain and collection auxiliary systems. On the basis of periodic visual inspections, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.21 Loss of Material Due to Pitting and Crevice Corrosion and Fouling

LRA Table 3.3.1, item 3.3.1-69, states that loss of material and fouling of stainless steel component types in various drain, waste collection, and sampling auxiliary systems exposed to raw water is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-69, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends the Fire Water System Program, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage the aging effect for various drain, waste collection, and sampling auxiliary systems. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.1.7. This program periodically visually inspects internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. During the audit and review, the staff confirmed that LRA Table 3.3.1, item 3.3.1-69, was for stainless steel component types exposed to raw water in drain, waste collection, and sampling auxiliary systems. On the basis of periodic visual inspections, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.22 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling

LRA Table 3.3.1, item 3.3.1-70, states that loss of material and fouling of copper alloy piping, piping components and piping elements, and system strainers in the oily drains system exposed to raw water is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-70, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends the Fire Water System Program, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage the aging effect for various drain, waste collection, and sampling auxiliary systems. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.1.7. This program periodically visually inspects the internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. During the audit and review, the staff confirmed that LRA Table 3.3.1, item 3.3.1-70, was for copper alloy component types exposed to raw water in the oily drains system. On the basis of periodic visual inspections, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.23 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-71, states that loss of material of steel component types in the diesel generator fuel oil storage and transfer, security power, and fire protection systems with air spaces above the fuel oil (air/gas (wetted) environment) is managed by a combination of the Fuel Oil Chemistry and One-Time Inspection Programs. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-71, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, the applicant proposed a combination of the Fuel Oil Chemistry and One-Time Inspection Programs to manage the aging effect for the steel surfaces above the fuel oil within various component types. The staff's evaluations of the Fuel Oil Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.5, respectively.

The Fuel Oil Chemistry Program maintains fuel oil quality by monitoring and controlling fuel oil contamination and by periodic testing to detect biological growth. The program minimizes exposure to fuel oil contaminants (*e.g.*, water and microbiological organisms) by verifying the quality of new oil, adding stabilizers before its introduction into the storage tanks, and periodically sampling for whether the tanks are free of water, particulates, and biological growth. The effectiveness of the program is verified by periodic tank inspections for whether significant degradation has occurred. The One-Time Inspection Program verifies the effectiveness of the Fuel Oil Chemistry Program. The staff confirmed that the diesel generator fuel oil storage and transfer, security power, and fire protection systems are within the scope of the One-Time Inspection Program to verify effectiveness of the Fuel Oil Chemistry Program to manage loss of material. On this basis, the staff finds the applicant's Fuel Oil Chemistry and One-Time Inspection Programs acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.24 Loss of Material Due to General, Pitting, Crevice, and (For Drip Pans and Drain Lines) Microbiologically Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-72 states that loss of material of steel surfaces in the diesel fuel oil storage tank building tank liners and fuel oil day tanks in the diesel fuel oil storage and transfer system with air spaces above the fuel oil (air/gas (wetted) environment) is managed by a combination of the Fuel Oil Chemistry and One-Time Inspection Programs. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-72 refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, the applicant proposed a combination of the Fuel Oil Chemistry and One-Time Inspection Programs to manage the aging effect for the steel surfaces above the fuel oil within various component types. The staff's evaluations of the Fuel Oil Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.5, respectively.

The Fuel Oil Chemistry Program maintains fuel oil quality by monitoring and controlling fuel oil contamination and by periodic testing to detect biological growth. The program minimizes exposure to fuel oil contaminants (*e.g.*, water and microbiological organisms) by verifying the quality of new oil, adding stabilizers before its introduction into the storage tanks, and periodically sampling for whether the tanks are free of water, particulates, and biological growth. The effectiveness of the program is verified by periodic tank inspections for whether significant degradation has occurred. The One-Time Inspection Program verifies the effectiveness of the Fuel Oil Chemistry Program. The staff confirmed that the diesel fuel oil storage and transfer system is within the scope of the One-Time Inspection Program to verify the effectiveness of the Fuel Oil Chemistry Program to manage loss of material. On this basis, the staff finds the applicant's Fuel Oil Chemistry and One-Time Inspection Programs acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.25 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion, Fouling, and Lining/Coating

LRA Table 3.3.1, item 3.3.1-76, states that loss of material for (1) carbon or low-alloy steel buried and above-ground piping, piping components, piping elements, fire service screen wash pumps, system strainers, normal service water pumps, normal service water seal and bearing water booster pumps in the circulating water, cooling tower make-up, screen wash, normal service water, and upflow filter systems and (2) gray cast-iron piping, piping components, piping elements, fire service screen wash pumps, and normal service water pumps in the cooling tower, screen wash, and normal service water systems with either a raw water internal or external environment is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and the External Surfaces Monitoring Program (for gray cast iron in external raw water environments in the cooling tower system only). Further, LRA Table 3.3.1, item 3.3.1-76, states that loss of material for carbon steel piping, piping components, and piping elements in the steam generator wet lay-up system in raw water environments is managed by the One-Time Inspection Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-76, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring Programs to manage the aging effects for various carbon or low-alloy steel and gray cast-iron component types. Furthermore, where the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the One-Time Inspection Program to manage aging effects for various carbon or low-alloy steel piping, piping components, and piping elements in the steam generator wet lay-up system. The staff's evaluations of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, External Surfaces Monitoring, and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.7, 3.0.3.1.5, and 3.0.3.2.16, respectively. During the audit and review, the staff asked the applicant to clarify how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program adequately manages aging effects for these components without the benefit of preventive measures by the Open-Cycle Cooling Water System Program.

In its response dated August 20, 2007, the applicant explained that the Open-Cycle Cooling Water System Program is based on GL 89-13, which addresses only safety-related emergency service water and emergency screen wash systems and excludes nonsafety-related systems except the normal service water system containment isolation valves, and that although these nonsafety-related components are outside the scope of GL 89-13 and the Open-Cycle Cooling Water System Program, they are subjected to the same preventive measures as those of the program. The applicant showed how the Open-Cycle Cooling Water System Program's preventive measures were present in the nonsafety-related systems even though GL 89-13 does not address them. Examples included the use of appropriate materials or linings and coatings to protect underlying material from aggressive cooling water environments and periodic flushing of stagnant system portions. The applicant further explained that some of the nonsafety-related systems utilize raw water from the cooling tower basin and that, because the cooling tower basin is the normal source of biocide chemical treatment for those systems addressed by GL 89-13, the nonsafety-related systems using the cooling tower basin are also treated with biocide equivalent to the requirements of the Open-Cycle Cooling Water System Program. The applicant listed nonsafety-related systems (*e.g.*, circulating water system, cooling tower system, normal service water system, and the waste processing building cooling water system) using the cooling tower basin as a source.

The applicant noted that, although the cooling tower make-up system, screen wash system, and the upflow filter system use water directly from the lake, their intended functions do not support safety-related functions. The applicant concluded that these systems therefore require no biocide as preventive measures because fouling would not prevent successful performance of their intended functions. The applicant stated that flushing of the nonsafety-related systems is for intended functions that require flow; however, flushing on those systems would not necessarily be within the scope of license renewal for spatial interactions. The applicant addressed silt build-up in Bays 1 and 8, from which the screen wash system takes suction, collocated with Bay 6. Additionally, the applicant explained that the safety-related emergency service water system (within the scope of GL 89-13) takes suction from Bays 6 and 8, which undergo periodic silting inspections with results documented and trended.

On the bases that the nonsafety-related carbon or low-alloy steel or gray cast-iron components in various auxiliary systems exposed to raw water are subject to periodic inspection and that its preventive actions are equivalent (as required) to those of the Open-Cycle Cooling Water System Program, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because its program elements would adequately manage the effects of aging.

On the bases that the nonsafety-related gray cast-iron components in the cooling water system exposed to raw water are subject to periodic inspection and that its preventive actions are equivalent (as required) to those of the Open-Cycle Cooling Water System Program, the staff finds the applicant's External Surfaces Monitoring Program acceptable because its program elements would adequately manage the effects of aging.

On the bases that the nonsafety-related carbon or low-alloy steel components in the steam generator wet lay-up system exposed to raw water are within the scope of license renewal solely for spatial interaction and that the component in this AMR result item is a sample cooler that, although cooled by raw water, is no longer in service, the staff finds the applicant's One-Time Inspection Program acceptable. The acceptability is based on the One-Time Inspection Program detection element for aging effects likely to progress slowly due to the system's retirement in place.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.26 Loss of Material Due to General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling

LRA Table 3.3.1, item 3.3.1-77, states that loss of material for carbon or low-alloy steel piping, piping components, and piping elements in the boron thermal regeneration system with raw water internal environments is managed by the One-Time Inspection Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-77, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the One-Time Inspection Program to manage the aging effects for various carbon or low-alloy steel component types. During the audit and review, the staff asked the applicant to clarify how this program is more suitable than the Open-Cycle Cooling Water System Program to manage this aging effect.

In its response dated August 20, 2007, the applicant explained that the assignment of the One-Time Inspection Program is not appropriate and that it would amend the LRA to reassign this result item (on LRA page 3.3-134) from the One-Time Inspection Program to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, delete the plant-specific Note 369 from this line item, and change the discussion column for LRA Table 3.3.1, item 3.3.1-77, to replace One-Time Inspection Program with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Programs is documented in SER Section 3.0.3.1.7. In the same August 20, 2007 letter, the applicant amended the LRA as described.

On the basis of periodic visual inspections of nonsafety-related carbon or low-alloy steel components in the boron thermal regeneration system exposed to raw water, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.27 Loss of Material Due to Pitting and Crevice Corrosion, and Fouling

LRA Table 3.3.1, item 3.3.1-79, states that loss of material for stainless steel piping, piping components, piping elements, system strainer screens/elements, and system strainers in the cooling tower, screen wash, normal service water, and upflow filter systems in either raw water internal or environments is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-79, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the aging effects for various stainless steel component types. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. During the audit and review, the staff asked the applicant to clarify how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program adequately manages aging effects for these components without the benefit of preventive measures by the Open-Cycle Cooling Water System Program.

The applicant's response and the staff's evaluation are in SER Section 3.3.2.1.25.

On the bases that the nonsafety-related stainless steel components in various auxiliary systems exposed to raw water are subject to periodic inspection and that their preventive actions are equivalent (as required) to those of the Open-Cycle Cooling Water System Program, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because its program elements would adequately manage the effects of aging.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.28 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-80, states that loss of material for stainless steel piping, piping components, piping elements, system strainer screens/elements, and system strainers in the cooling tower, screen wash, normal service water, upflow filter, and reactor auxiliary building ventilation systems in either raw water internal or external air/gas (wetted outside) environments is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-80, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the aging effects for various stainless steel component types. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Sections 3.0.3.1.7. During the audit and review, the staff asked the applicant to clarify how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program adequately manages aging effects for these components without the benefit of preventive measures by the Open-Cycle Cooling Water System Program.

The applicant's response and the staff's evaluation are in SER Section 3.3.2.1.25.

On the bases that the nonsafety-related stainless steel components in various auxiliary systems exposed to raw water or air/gas (wetted outside) are subject to periodic inspection and that their preventive actions are equivalent (as required) to those of the Open-Cycle Cooling Water System Program, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because its program elements would adequately manage the effects of aging.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.29 Loss of Material Due to Pitting, Crevice, Microbiologically-Influenced Corrosion, and Fouling

LRA Table 3.3.1, item 3.3.1-81, states that loss of material for copper alloy piping, piping components, piping elements, and system strainer screens/elements in the screen wash, waste processing building cooling water, and upflow filter systems with raw water internal environments is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-81, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the aging effects for various copper alloy component types. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. During the audit and review, the staff asked the applicant to clarify how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program adequately manages aging effects for these components without the benefit of preventive measures by the Open-Cycle Cooling Water System Program.

The applicant's response and the staff's evaluation are in SER Section 3.3.2.1.25.

On the bases that nonsafety-related copper alloy components in various auxiliary systems exposed to raw water are subject to periodic inspection and that their preventive actions are equivalent (as required) to those of the Open-Cycle Cooling Water System Program, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because its program elements would adequately manage the effects of aging.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.30 Loss of Material Due to Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling

LRA Table 3.3.1, item 3.3.1-82, states that loss of material from copper alloy piping, piping components, and piping elements in the waste processing building cooling water system with raw water internal environments is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that the AMR result item referring to LRA Table 3.3.1, item 3.3.1-82, refers to Note E.

The staff reviewed the AMR result item referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the aging effects for copper alloy piping, piping components, and piping elements. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. During the audit and review, the staff asked the applicant to clarify how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program adequately manages aging effects for these components without the benefit of preventive measures by the Open-Cycle Cooling Water System Program.

The applicant's response and the staff's evaluation are in SER Section 3.3.2.1.25.

On the bases that the nonsafety-related copper alloy components in the waste processing building cooling water system exposed to raw water are subject to periodic inspection and that their preventive actions are equivalent (as required) to those of the Open-Cycle Cooling Water System Program, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because its program elements would adequately manage the effects of aging.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.31 Loss of Material Due to Boric Acid Corrosion

LRA Table 3.3.2-14 shows Table 3.3.1, item 3.3.1-89, managing loss of material due to boric acid corrosion for carbon or low-alloy steel piping, piping components, piping elements, and tanks exposed to treated water (inside). During the audit and review, the staff asked the applicant to justify the use of this Table 1 item to manage this aging effect for component types exposed to this environment.

In its response dated August 20, 2007, the applicant stated that there was a mistake in LRA Table 3.3.2-14 on page 3.3-201. Under carbon or low-alloy steel piping, piping components, piping elements, and tanks, the environment for results items which refer to Table 3.3.1, items 3.3.1-59 and 3.3.1-89 should read "air - indoor (outside)." In the same August 20, 2007 letter, the applicant amended LRA Table 3.3.2-14 for these components to make this correction. With this change, the staff finds the response consistent with the GALL Report and acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.32 Cracking Due to Stress Corrosion Cracking

LRA Table 3.3.1, item 3.3.1-90, states that cracking for stainless steel piping, piping components, and piping elements in the spent resin storage and transfer system in treated water internal environments is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that the AMR result item referring to LRA Table 3.3.1, item 3.3.1-90, refers to Note E.

The staff reviewed the AMR result item referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M2, "Water Chemistry," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the aging effects for stainless steel piping, piping components, and piping elements. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. During the audit and review the staff asked the applicant how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program adequately manages aging effects for these components without the benefit of preventive measures by the Water Chemistry Program.

In its response dated August 20, 2007, the applicant explained that the LRA was incorrect in applying the AMR result item because the fluid temperature is not likely to exceed that required for this mechanism. The applicant further stated that it would amend the LRA to delete this AMR line. In the same letter, the applicant amended LRA Table 3.3.2-49 to delete this AMR line.

On the basis that the normal fluid temperature does not exceed the threshold for SCC in stainless steel piping, piping components, and piping elements the staff finds the applicant's deletion of this AMR result item acceptable.

On the bases of its review of the AMR result item and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

3.3.2.1.33 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-91, states that loss of material of stainless steel component types in the radioactive equipment drains and spent resin storage and transfer systems in treated water internal environments is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During the audit and review, the staff noted that the AMR result items referring to LRA Table 3.3.1, item 3.3.1-91, refer to Note E.

The staff reviewed the AMR result items referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M2, "Water Chemistry," the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the aging effects for stainless steel piping, piping components, and piping elements. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. During the audit and review, the staff asked the applicant to clarify how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program adequately manages aging effects for these components without the benefit of preventive measures by the Open-Cycle Cooling Water System Program.

In its letter response August 20, 2007, the applicant explained that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was in lieu of the Water Chemistry Program because neither system is safety-related. The applicant stated that the periodic inspections proceed during routine maintenance when the surfaces are accessible for visual inspection. Additionally, the program visually inspects for whether existing environmental conditions cause material degradation that could result in a loss of component intended functions. The applicant concluded that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components manages the equipment appropriately.

On the bases that the applicant clarified that these nonsafety-related components are routinely inspected through normal maintenance and that they are normally accessible, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable.

On the bases of its review of the AMR result items and its comparison of the applicant's results to corresponding GALL Report recommendations, the staff finds that the applicant addressed the aging effect or mechanism appropriately as recommended by the GALL Report.

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).

3.3.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.3.2.2, the applicant further evaluates 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
- SCC
- SCC and cracking due to 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, stating that such reduction of heat transfer could occur for stainless steel heat exchanger tubes exposed to treated water. The SRP-LR and the GALL Report apply this aging mechanism or effect to both BWR and PWR nuclear power plants; however, unique items VII.A4-4 (AP-62) and VII.E3-6 (AP-62) apply to BWR plants only.

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.

On the basis that unique items VII.A4-4 (AP-62) and VII.E3-6 (AP-62) apply to BWR plants only because the stainless steel heat exchanger tubes subject to reduction of heat transfer due to fouling refer to BWR spent fuel pool cooling and cleanup and reactor water cleanup systems, the staff finds acceptable the applicant's evaluation that this aging effect is not present at HNP, a PWR plant.

On the basis that HNP has no components from this group, the staff finds that this aging effect is not present.

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 SCC in BWR standby liquid control system components, stating that this aging effect does not apply to HNP, a PWR plant.

SRP-LR Section 3.3.2.2.3 states that SCC could occur in the stainless steel piping, piping components, and piping elements of the BWR standby liquid control system exposed to sodium pentaborate solution greater than 60 °C (140 °F).

The staff finds acceptable the applicant's evaluation that this aging effect is not present at HNP, a PWR plant.

(2) LRA Section 3.3.2.2.3 addresses SCC in heat exchanger components, stating that the SRP-LR and the GALL Report apply this aging mechanism or effect to both PWR and

BWR nuclear power plants; however, Unique Items VII.E3-3 (A-71) and VII.E3-19 (A-85) apply to BWR systems only (*i.e.*, the reactor water cleanup system).

SRP-LR Section 3.3.2.2.3 states that SCC may occur in stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 60 °C (140 °F). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff finds acceptable the applicant's evaluation that this aging effect is not present at HNP, a PWR plant.

(3) LRA Section 3.3.2.2.3 addresses SCC in stainless steel diesel exhaust piping, stating that such cracking could occur in piping, piping components, and piping elements exposed to diesel exhaust. The carbon steel emergency diesel generator system diesel engine exhaust piping has a stainless steel expansion joint for which SCC is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The program assures by visual inspections that environmental conditions cause no material degradation that could result in a loss of component intended functions.

SRP-LR Section 3.3.2.2.3 states that 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.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and determined that by visual techniques for inspecting the stainless steel diesel exhaust components the aging effect of cracking will be adequately managed.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.3 criteria. For those line items that apply to LRA Section 3.3.2.2.3, 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).

3.3.2.2.4 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 SCC and cyclic loading in cracking of PWR nonregenerative heat exchanger components, stating that such cracking could occur in stainless steel nonregenerative heat exchanger components exposed to treated water greater than 140 °F in the chemical and volume control system. A combination of the Water Chemistry Program and the One-Time Inspection Program manages cracking of

chemical and volume control system heat exchanger components. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the cracking and loss of material aging effects. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation. The applicant has selected the One-Time Inspection Program in lieu of radioactivity monitoring of the shell side water and eddy-current testing of tubes.

SRP-LR Section 3.3.2.2.4 states that SCC and cyclic loading could 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 existing AMP monitors and controls primary water chemistry in PWRs to manage the aging effects of SCC; however, control of water chemistry does not preclude SCC and cracking due to cyclic loading; therefore, the effectiveness of water chemistry control programs should be verified to ensure that cracking does not occur. The GALL Report recommends that a plant-specific AMP be evaluated to verify the absence of SCC and cracking due to cyclic loading to ensure that these aging effects are adequately managed. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water and eddy current testing of tubes.

The staff reviewed LRA Section 3.3.2.2.4, which credits the Water Chemistry and the One-Time Inspection Programs in combination for managing SCC and cracking due to cyclic loading of stainless steel nonregenerative heat exchanger components. The staff determined that the One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program to manage cracking for stainless steel nonregenerative heat exchanger components in the CVCS. On the basis of its review, the staff finds that the applicant has met the criteria of SRP-LR Section 3.3.2.2.4 by verifying the effectiveness of the Water Chemistry Program by one-time inspections.

(2) LRA Section 3.3.2.2.4 addresses SCC and cyclic loading in cracking of PWR regenerative heat exchanger components, stating that such cracking could occur in stainless steel regenerative heat exchanger components exposed to treated water greater than 140 °F. A combination of the Water Chemistry Program and the One-Time Inspection Program manages cracking of CVCS heat exchanger components.

SRP-LR Section 3.3.2.2.4 states that SCC and cracking due to cyclic loading may occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 60 °C (140 °F). The existing AMP monitors and controls primary water chemistry in PWRs to manage the aging effects of SCC; however, control of water chemistry does not preclude SCC and cracking due to cyclic loading; therefore, the effectiveness of water chemistry control programs should be verified to ensure that cracking does not occur. The GALL Report recommends that a plant-specific AMP be evaluated to verify the absence of SCC and cracking due to cyclic loading to ensure that these aging effects are adequately managed.

The staff reviewed LRA Section 3.3.2.2.4, which credits the Water Chemistry and the One-Time Inspection Programs in combination for managing SCC and cracking due to cyclic loading of stainless steel regenerative heat exchanger components. The staff determined that the One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program in managing cracking for such components. On the basis of its review, the staff finds that the applicant has met the criteria of SRP-LR Section 3.3.2.2.4 by verifying the effectiveness of the Water Chemistry Program by one-time inspections.

(3) LRA Section 3.3.2.2.4 addresses SCC and cyclic loading in cracking of PWR pumps in the CVCS, stating that a combination of the Water Chemistry Program and the One-Time Inspection Program manages cracking of CVCS stainless steel pump casings. The Water chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate the cracking aging effect. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

SRP-LR Section 3.3.2.2.4 states that SCC and cracking due to 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 SCC; however, control of water chemistry does not preclude SCC and cracking due to cyclic loading; therefore, the effectiveness of water chemistry control programs should be verified to ensure that cracking does not occur. The GALL Report recommends that a plant-specific AMP be evaluated to verify the absence of SCC and cracking due to cyclic loading to ensure that these aging effects are adequately managed.

The staff reviewed LRA Section 3.3.2.2.4, which credits the Water Chemistry and the One-Time Inspection Programs in combination for managing SCC and cracking due to cyclic loading of stainless steel pump casings. The staff determined that the One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program in managing cracking for CVCS stainless steel pump casings. On the basis of its review, the staff finds that the applicant has met the criteria of SRP-LR Section 3.3.2.2.4 by verifying the effectiveness of the Water Chemistry Program by one-time inspections.

(4) LRA Section 3.3.2.2.4 addresses SCC and cyclic loading in high-strength bolting exposed to steam or water leakage, stating that this aging effect is not present because HNP selects proper bolting material and lubricants and, through control of bolt torque, has eliminated bolting SCC effectively. Industry data and plant-specific operating experience support this conclusion.

During the onsite audit, the staff confirmed that there is no high-strength steel closure bolting in the auxiliary systems. On the basis that there are no components of this type exposed to steam or water leakage in the auxiliary systems, the staff finds acceptable the applicant's evaluation that this aging effect is not present.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.4 criteria. For those line items that apply to LRA Section 3.3.2.2.4, 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).

3.3.2.2.5 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 HVAC system elastomer seals and components, stating that such hardening and loss of strength could occur in seals and components exposed to indoor air on internal or external surfaces. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages the internal surfaces of the HVAC system components and also manages similar aging effects of the diaphragm in the CVCS boric acid tank by internal inspections during periodic system and component surveillances or during maintenance activities when the surfaces are accessible. The visual inspections assure that environmental conditions cause no material degradation that could result in loss of component intended functions. The External Surfaces Monitoring Program manages the external surfaces of HVAC system components by system inspections and walk-downs with periodic visual inspections of steel components (*i.e.*, piping, piping components, ducting) and other components within the scope of license renewal and subject to AMR.

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.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring Programs, which together periodically inspect internal and external surfaces of HVAC components and the boric acid tank diaphragm during periodic system walk-downs and inspections when the surfaces are accessible. On the basis of periodic inspections, including opportunistic inspections of component internal surfaces, the staff determines that the Internal Surfaces in Miscellaneous Piping and Ducting Components and the External Surfaces Monitoring Programs will adequately manage the aging effects through the period of extended operation.

(2) LRA Section 3.3.2.2.5 addresses hardening and loss of strength and components in HVAC systems in degradation of elastomer linings of components in spent fuel pool cooling and cleanup system components, stating that this aging effect is not present

because HNP spent fuel pool cooling and cleanup components have no elastomer lining.

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.

On the basis that the spent fuel pool cooling and cleanup systems do not use elastomer linings, the staff finds acceptable the application's evaluation that this aging effect is not present.

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, stating that such reduction of neutron-absorbing capacity and loss of material could occur in the neutron-absorbing materials of spent fuel storage racks exposed to treated water or treated borated water. The AMR evaluation reviewed current monitoring results for Boral testing and determined that the record of adverse plant-specific operating experience is negligible. Additionally, the staff has evaluated both the Virgil C. Summer and Brunswick Steam Electric nuclear plants for the aging effect of reduction of neutron-absorbing capacity. The SERs for license renewal (NUREG-1787 for Summer, NUREG-1856 for Brunswick) determined the aging effect to be insignificant; therefore, the conclusion is that reduction of neutron-absorbing capacity for Boral requires no aging management. The Water Chemistry Program, however, will continue to manage the aging effect of loss of material.

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 the onsite audit, the staff asked how the Water Chemistry Program will detect the loss of material.

In its response dated August 20, 2007, the applicant stated that recent plant-specific Boral testing results found negligible loss of material. Additionally, the applicant evaluated industry operating experience that also confirms that loss of material is a negligible aging effect for Boral spent fuel pool components. The applicant indicated that it would amend the LRA to indicate that Boral has no AERMs. The LRA plant-specific note for the Boral line item will be revised to clarify that Boral material has no AERMs. In the same August 20, 2007 letter, the applicant amended LRA Table 3.5.2-17, Table 3.3.2, item 3.3.1-13, Subsection 3.3.2.2.6, and Note 570 to state that Boral material has no aging effects. Based on plant-specific and industry operating experience indicating that Boral material has no aging effects, the staff finds this response acceptable.

Based on the information provided above, the staff concludes that LRA Table 3.3.1, item 3.3.1-13 no longer applies to the amended LRA.

On the basis that HNP has no components from this group, the staff finds that this aging effect is not present.

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 steel components exposed to lubricating oil, stating that such loss of material could occur in steel components, including the reactor coolant pump lube oil leakage collection system, exposed to lubricating oil. Piping, tubing, valves, and tanks may be affected. A combination of the Lubricating Oil Analysis Program and the One-Time Inspection Program manages piping components exposed to lubricating oil. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain intended functions of affected components during the period of extended operation. The One-Time Inspection Program determines the thickness of the lower portion of the reactor coolant pump oil collection tank.

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 reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and determined that these programs will manage the aging effects of loss of material due to general, pitting, and crevice corrosion in steel components exposed to lubricating oil effectively. The staff determined that the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program in managing loss of material due to general, pitting, and crevice corrosion for steel components exposed to lubricating oil. In addition, the One-Time Inspection Program, as stated in LRA Section 3.3.2.2.7, determines the thickness of the lower portion of the RCP oil collection tank. On the basis of its review, the staff finds that the applicant has met the criteria of SRP-LR Section 3.3.2.2.7 by verifying the effectiveness of the Lubricating Oil Analysis Program by one-time inspections.

(2) LRA Section 3.3.2.2.7 addresses loss of material due to general, pitting, and crevice corrosion in BWR reactor water cleanup and shutdown cooling systems, stating that this aging effect does not apply to HNP, a PWR plant.

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 staff finds acceptable the applicant's evaluation that this aging effect is not present at HNP, a PWR plant.

(3) LRA Section 3.3.2.2.7 addresses loss of material due to general (steel only), pitting, and crevice corrosion in diesel engine exhaust system piping, stating that loss of material could occur in steel and stainless steel piping, piping components, and piping elements exposed to diesel exhaust. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages the internal surfaces of piping components exposed to diesel exhaust by internal inspections during the periodic system and component surveillance or during maintenance activities when the surfaces are made accessible to assure that environmental conditions cause no material degradation that could result in a loss of component intended functions.

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.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program that the applicant proposed in lieu of a plant-specific program and determined that by visual techniques for inspecting the steel and stainless steel diesel exhaust components, the aging effects will be adequately managed for the period of extended operation.

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, and crevice corrosion and MIC, stating that such loss of material could occur for steel piping, piping components, and piping elements buried in soil regardless of pipe coatings or wrappings. The Buried Piping and Tanks Inspection Program manages the external surfaces of piping components exposed to soil by preventive measures (*e.g.*, coatings and wrappings required by design) to mitigate degradation and by visual inspections of external surfaces of buried piping components, when excavated, for evidence of coating damage and degradation.

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 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, ensuring that loss of material does not occur.

The staff reviewed the Buried Piping and Tanks Inspection Program that the applicant proposes for managing aging effects for buried components. The Buried Piping and Tanks Inspection Program requires documentation of as-found conditions of piping and coatings during any excavation, focused inspections at least every 10 years, one detailed inspection within the 10-year period prior to the period of extended operation, and inspection requirements and their results documented and retained. Finally, inspections will be by qualified inspectors with a coatings engineer to assess the effectiveness of coatings to protect buried components within the scope of the program. On the basis of the requirements of the Buried Piping and Tanks

Inspection Program, the staff determines that the program will adequately manage the aging effects through the period of extended operation.

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, and crevice corrosion, MIC, and fouling in steel components exposed to fuel oil, stating that such loss of material could occur for steel piping, piping components, piping elements, and tanks exposed to fuel oil. A combination of the Fuel Oil Chemistry Program and the One-Time Inspection Program manages piping components and tanks exposed to fuel oil. The Fuel Oil Chemistry Program maintains fuel oil quality by monitoring and controlling fuel oil contamination in accordance with plant technical specifications and American Society for Testing and Materials guidelines. Exposure to fuel oil contaminants (*e.g.*, water and microbiological organisms) is minimized by periodic draining or cleaning of tanks and by verifying new oil quality before its introduction into the storage tanks. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain intended functions of affected components during the period of extended operation.

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 reviewed the Fuel Oil Chemistry Program and the One-Time Inspection Program that the applicant proposes for managing aging effects of steel piping and tanks in fuel oil environments. The Fuel Oil Chemistry Program verifies fuel oil quality before introducing it to the system tanks and periodically checks for water accumulation, biological growth, and sediments. The Fuel Oil Chemistry Program requires corrective actions when fuel oil condition is out of tolerance. The One-Time Inspection Program verifies Fuel Oil Chemistry Program effectiveness. On the basis of the requirements of the Fuel Oil Chemistry Program and One-Time Inspection Program, the staff determines that they will adequately manage the aging effects through the period of extended operation.

(2) LRA Section 3.3.2.2.9 addresses loss of material due to general, pitting, and crevice corrosion, MIC, and fouling in steel heat exchanger components exposed to lubricating oil, stating that such loss of material could occur for steel heat exchanger components exposed to lubricating oil. A combination of the Lubricating Oil Analysis Program and the One-Time Inspection Program manages piping components exposed to lubricating oil. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

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 reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program that the applicant proposes for managing loss of material for steel heat exchanger components in lubricating oil environments and determines that they will adequately manage the aging effects for the period of extended operation. The staff determined that the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program in managing loss of material for steel components exposed to lubricating oil. On the basis of its review, the staff finds that the applicant has met the criteria of SRP-LR Section 3.3.2.2.9 by verifying the effectiveness of the Lubricating Oil Analysis Program by one-time inspections.

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 elastomer-lined steel components exposed to treated or treated borated water, stating that this aging effect is not present because the HNP spent fuel pool cooling and cleanup components have no elastomer lining.

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.

On the basis that the HNP spent fuel pool cooling and cleanup systems do not use elastomer linings, the staff finds acceptable the application's evaluation that this aging effect is not present.

(2) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in stainless steel, steel with stainless cladding, and aluminum components exposed to treated water, stating that such loss of material for BWR Spent Fuel Pool Cooling and Cleanup, Reactor Water Cleanup, and Shutdown Cooling System piping components is occurs in BWR plants only. The SRP-LR applies this aging mechanism or effect to both BWR and PWR plants; however, Unique Items VII.A4-11, VII.E3-15, VII.E4-14, VII.A4-5, VII.E3-7, and VII.E4-4 apply only to BWR plants.

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 finds acceptable the applicant's evaluation that this aging effect is not present at HNP, a PWR plant.

(3) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in copper alloy HVAC components exposed to condensation, stating that for copper alloy with a zinc content of less than 15 percent the AMR methodology does not predict aging

effects in the absence of contaminants. In the HVAC systems, condensation is present but drained away as it forms on the cooling coil to inhibit the concentration of contaminants.

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 staff reviewed LRA Section 3.3.2.2.10, which states that copper alloy HVAC piping, piping components, and piping elements exposed to condensation have no probable aging effects. During the audit and review, the staff asked the applicant to explain why there are no aging effects for the copper alloy HVAC components.

In its response, the applicant explained that the specific HVAC components for this aging effect are the actual cooling coils within the HVAC unit and that, due to the orientation of the tubing comprising the cooling coils and its round shape with no fins, contaminants cannot collect and concentrate. Additionally, the air is filtered and contaminants removed before they can settle on the tubing and filters are periodically replaced to ensure their effectiveness. Lastly, the plant-specific operating experience shows no external age-related degradation for copper alloy HVAC cooling coils. On the basis that contaminants are not able to collect and concentrate on the cooling coils because of their orientation absence of fins, the staff concurs that there are no aging effects.

(4) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in copper alloy HVAC piping components exposed to lubricating oil, stating that such loss of material could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The Lubricating Oil Analysis Program and the One-Time Inspection Program manage piping components exposed to lubricating oil. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

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 reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program that the applicant proposes for managing loss of material for copper and copper alloy components in lubricating oil environments and determines that they will adequately manage the aging effects for the period of extended operation. The staff determined that the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program in managing loss of material for steel components exposed to lubricating oil. On the basis of its review, the staff finds that the applicant has met the criteria of SRP-LR Section 3.3.2.2.10 by verifying the effectiveness of the Lubricating Oil Analysis Program by one-time inspections.

(5) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in aluminum HVAC components and stainless steel components exposed to condensation, stating that such loss of material could occur for HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components so exposed. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages this aging effect for the bird screens in the containment purge system by internal inspections during the periodic system and component surveillances or during maintenance activities when the surfaces are accessible to assure that environmental conditions cause no material degradation that could result in a loss of component intended functions.

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 staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program that the applicant proposed in lieu of a plant-specific program and determined that by visual techniques for inspecting stainless steel and aluminum HVAC components exposed to condensation, the aging effects will be adequately managed for the period of extended operation.

(6) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in copper alloy fire protection piping components exposed to condensation, stating that such loss of material could occur for copper alloy fire protection system piping, piping components, and piping elements so exposed. The applicant considers condensing environments as capable of concentrating contaminants and assumed, therefore, a raw water environment for these components. Either the Fire Water System Program or the Selective Leaching of Materials Program manages fire protection system copper alloy components exposed internally to condensation. The Fire Water System Program monitors system pressure, evaluates wall thickness, periodically tests flow and pressure in accordance with applicable National Fire Protection Association commitments, and periodically inspects overall system condition visually. The Selective Leaching of

Materials Program includes one-time inspections and qualitative determinations for selected components that may be susceptible to selective leaching.

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 Fire Water System Program and the Selective Leaching of Materials Program, either of which the applicant proposes for managing loss of material for copper alloy fire protection piping, piping components, and piping elements internally exposed to condensation environments. The staff determines that either program will adequately manage the aging effects for the period of extended operation because either adequately detects and quantifies loss of material for these components. On this basis, the staff finds that the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.

(7) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in stainless steel piping components exposed to soil, stating that this aging effect is not present because the systems containing service water and the fire protection, diesel generator fuel oil storage and transfer system, and emergency diesel generator system have no stainless steel components exposed to soil; therefore, this loss of material is not present.

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.

On the basis that the HNP has no stainless steel piping components exposed to soil, the staff finds acceptable the application's evaluation that this aging effect is not present.

(8) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion of the BWR standby liquid control system, stating that this aging effect does not apply to HNP, a PWR plant.

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 standby liquid control system exposed to sodium pentaborate solution.

The staff finds acceptable the applicant's evaluation that this aging effect is not present at HNP, a PWR plant.

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, stating that this aging effect does not apply to HNP, a PWR plant.

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.

The staff finds acceptable the applicant's evaluation that this aging effect is not present at HNP, a PWR plant.

On the basis that HNP has no components from this group, the staff finds that this aging effect is not present.

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 and crevice corrosion and MIC in stainless steel, aluminum, and copper alloy components exposed to fuel oil, stating that such loss of material could occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. The Fuel Oil Chemistry and the One-Time Inspection Programs manage piping components (except the diesel-driven fire pump fuel oil supply line) exposed to fuel oil. The Fuel Oil Chemistry Program monitors and controls fuel oil contamination to maintain fuel oil quality in accordance with plans technical specifications and American Society for Testing and Materials guidelines. Exposure to fuel oil contaminants (*e.g.*, water and microbiological organisms) is minimized by periodic draining or cleaning of tanks and by verifying new oil quality before its introduction into the storage tanks. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation. Aging management of the diesel-driven fire pump fuel oil line is by a combination of the Fuel Oil Chemistry Program and the Fire Protection Program.

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 Fuel Oil Chemistry Program and the One-Time Inspection Program that the applicant proposes for managing aging effects of stainless steel, aluminum, and copper alloy piping and tanks in fuel oil environments. The Fuel Oil Chemistry Program verifies fuel oil quality before introducing it into the system tanks and periodically checks for water accumulation, biological growth, and sediments. The Fuel Oil Chemistry Program requires corrective actions when fuel oil condition is out of tolerance. The One-Time Inspection Program verifies Fuel Oil Chemistry Program effectiveness. On the basis of the requirements of the Fuel Oil Chemistry Program and One-Time Inspection Program, the staff determines that they will adequately manage the aging effects through the period of extended operation.

For the diesel-driven fire pump fuel oil line, the Fuel Oil Chemistry Program verifies fuel oil quality before introducing it into the system tanks and periodically checks for water accumulation, biological growth, and sediments. The Fire Protection Program, upon enhancement, will periodically visually inspect the fuel oil supply piping for leakage. On this basis, the staff determines that the Fuel Oil Chemistry and Fire Protection Programs will manage the aging effects through the period of extended operation for the diesel-driven fire pump fuel oil line.

(2) LRA Section 3.3.2.2.12 addresses loss of material due to pitting and crevice corrosion and MIC in stainless steel piping components exposed to lubricating oil, stating that such loss of material could occur in stainless steel piping, piping components, and piping elements exposed to lubricating oil. A combination of the Lubricating Oil Analysis Program and the One-Time Inspection Program manages piping components exposed to lubricating oil. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

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 reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program that the applicant proposes for managing stainless steel piping, piping elements, and piping components in lubricating oil environments and determines that they will adequately manage the aging effects for the period of extended operation. The staff determined that the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program in managing loss of material for steel components exposed to lubricating oil. On the basis of its review, the staff finds that the applicant has met the criteria of SRP-LR Section 3.3.2.2.12 by verifying the effectiveness of the Lubricating Oil Analysis Program by one-time inspections.

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, stating that such loss of material could occur in elastomer seals and components in an indoor air environment. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages the internal surfaces of HVAC system components by internal inspections during the periodic system and component surveillances or during maintenance activities when the surfaces are made accessible to assure that environmental conditions cause no material degradation that could result in a loss of component intended functions.

LRA Section 3.3.2.2.13 addresses management of loss of material due to wear for the external surfaces of the ventilation system components by External Surfaces Monitoring Program system inspections and walkdowns. This program periodically visually inspects steel components *(e.g.*, piping, piping components, ducting) and other components within the scope of license renewal and subject to AMR in order to manage aging effects through visual inspection of external surfaces for material loss.

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.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring Programs, which together inspect internal and external surfaces of HVAC components during periodic system walkdowns and inspections when the surfaces are accessible. On the basis of periodic inspections, including opportunistic inspections of component internal surfaces, the staff determines that the Internal Surfaces in Miscellaneous Piping and Ducting Components and the External Surfaces Monitoring Programs will adequately manage the aging effects through the period of extended operation.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.13 criteria. For those line items that apply to LRA Section 3.3.2.2.13, 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).

3.3.2.2.14 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, stating that this aging effect is not present because the charging pumps are fabricated from stainless steel and not from carbon steel with stainless steel cladding.

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.

On the basis that HNP has no steel charging pump casings with stainless steel cladding exposed to treated borated water, the staff finds acceptable the application's evaluation that this aging effect is not present. On the basis that HNP has no components from this group, the staff finds that this aging effect is not present.

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 3.3.2-71, 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 3.3.2-71, 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 Auxiliary Systems - Summary of Aging Management Evaluation - Chemical and Volume Control 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 chemical and volume control system component groups.

In LRA Table 3.3.2-1, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to environments of air-indoor.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload of stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-1, the applicant proposed the Selective Leaching of Materials Program to manage loss of material due to selective leaching for gray cast-iron CSIP lube oil pumps and gray cast-iron or copper alloy greater than 15-percent zinc CSIP lube oil piping components exposed to internal environments of lubricating oil or hydraulic fluid.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended function for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, the staff finds that the aging effect of loss of material due to selective leaching of gray cast-iron CSIP lube oil pumps and gray cast-iron or copper alloy greater than 15 percent zinc CSIP lube oil piping components exposed to internal environments of lubricating oil or hydraulic fluid will be effectively managed by the Selective Leaching of Materials Program.

In LRA Table 3.3.2-1, the applicant proposed a TLAA to manage cracking due to thermal fatigue for carbon or low-alloy steel piping, piping components, and piping elements exposed to internal environments of treated water.

The staff evaluation of the TLAA is documented in SER Section 4.3.

In LRA Table 3.3.2-1, the applicant proposed the Lubricating Oil Analysis and One-Time Inspection Programs to manage SCC for stainless steel CSIP gear oil cooler, CSIP oil cooler, and CSIP lube oil piping component types exposed to internal lubricating oil or hydraulic fluid environments.

The staff's evaluations of the Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. The Lubricating Oil Analysis Program description states that the program maintains oil system contaminates (primarily water and particulates) within acceptable limits by sampling to preserve an environment not conducive to cracking. The One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program. On the basis of its review, the staff finds that the aging effect of SCC for stainless steel CSIP gear oil cooler, CSIP oil cooler, and CSIP lube oil piping component types exposed to internal lubricating oil or hydraulic fluid environments will be effectively managed by the Lubricating Oil Analysis and One-Time Inspection Programs.

In LRA Table 3.3.2-1, the applicant proposed the Lubricating Oil Analysis and One-Time Inspection Programs to manage loss of material due to galvanic corrosion for carbon or low-alloy steel CSIP gear lube oil pumps exposed to internal environments of lubricating oil or hydraulic fluid.

The staff's evaluations of the Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. The Lubricating Oil Analysis Program description states that the program maintains the oil system contaminates (primarily water and particulates) within acceptable limits by sampling to preserve an environment not conducive to loss of material. During the onsite audit, the staff asked the applicant to clarify the use of this program to manage loss of material due to galvanic corrosion.

In its response dated August 20, 2007, the applicant stated that lubricating oil produces no potential aging effects due to galvanic corrosion without water contamination and pooling in contact with dissimilar metals. On the basis that the Lubricating Oil Analysis Program maintains the water contamination within acceptable limits, the staff finds this response acceptable. In addition, the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program. On the basis of its review, the staff finds that the aging effect of loss of material due to galvanic corrosion of carbon or low-alloy steel CSIP gear lube oil pumps exposed to internal environments of lubricating oil or hydraulic fluid will be effectively managed by the Lubricating Oil Analysis and One-Time Inspection Programs.

In LRA Table 3.3.2-1, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer tank diaphragm component types exposed to internal environments of treated water or environments of air-indoor. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. During the onsite audit, the staff asked the applicant to clarify how a visual inspection would detect the change in material properties for elastomer component types.

In its response dated August 20, 2007, the applicant stated that it would amend the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to include in addition to visual inspections physical manipulation of the elastomer components to detect aging degradation. Physical manipulation of the elastomer component types adds a mechanism to detect change in material properties due to aging degradation. In the same August 20, 2007 letter, the applicant amended the LRA Section B.2.24 program description to add elastomeric component physical manipulations to detect aging effects. The staff finds this response acceptable.

The staff finds that the aging effect of change in material properties and cracking due to various degradation mechanisms for elastomer tank diaphragm component types exposed to internal environments of treated water or environments of air-indoor will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-1 states that piping thermal insulation exposed to air-indoor environments exhibits no AERMs. During the audit and review, the staff confirmed that the materials in HNP thermal insulation include elastomeric closed-cell foam, phenolic foam, calcium silicate, sodium silicate, mineral wool, glass wool, refractory fiber, rigid fibrous glass, insulation board, and fiberglass, that these insulation types similar to those elsewhere in the industry have exhibited no age-related degradation, and that plant-specific operating experience shows no aging effects for these materials. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that thermal insulation material exposed to air-indoor environments has any AERMs for its intended function.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Boron Thermal Regeneration 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 boron thermal regeneration system component groups.

In LRA Table 3.3.2-2, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to external air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload of stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-2, the applicant proposed the Selective Leaching of Materials Program to manage loss of material due to selective leaching for copper alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to internal environments of lubricating oil or hydraulic fluid.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended functions for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, the staff finds that the aging effect of loss of material due to selective leaching of copper alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to internal environments of lubricating oil or hydraulic fluid will be effectively managed by the Selective Leaching of Materials Program.

In LRA Table 3.3.2-2, the applicant proposed the Lubricating Oil Analysis and One-Time Inspection Programs to manage loss of material due to galvanic corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to internal environments of lubricating oil or hydraulic fluid.

The staff's evaluations of the Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. The Lubricating Oil Analysis Program description states that the program maintains oil system contaminates (primarily water and particulates) within acceptable limits by sampling to preserve an environment not conducive to loss of material. During the onsite audit, the staff asked the applicant to clarify the use of this program to manage loss of material due to galvanic corrosion.

In its letter dated August 20, 2007, the applicant stated that lubricating oil produces no potential aging effects due to galvanic corrosion without water contamination and pooling in contact with dissimilar metals. On the basis that the Lubricating Oil Analysis Program maintains the water contamination within acceptable limits, the staff finds this statement acceptable. In addition, the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program. On the basis of its review, because the staff finds that the aging effect of loss of material due to galvanic corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to internal environments of lubricating oil or hydraulic fluid will be effectively managed by the Lubricating Oil Analysis and One-Time Inspection Programs.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Primary Makeup 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 primary makeup system component groups.

In LRA Table 3.3.2-3, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments or air-outdoor and carbon or low-alloy steel closure bolting exposed to environments of air-outdoor.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload of stainless steel closure bolting exposed to air-indoor environments or air-outdoor and carbon or low-alloy steel closure bolting exposed to environments of air-outdoor will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-3, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer tank diaphragm component types exposed to internal environments of treated water or environments of air-indoor.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of degradation. During the onsite audit, the staff asked the applicant to clarify how a visual inspection would detect change in material properties for elastomer component types.

In its letter dated August 20, 2007, the applicant stated that it would amend the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to include physical manipulation of the elastomer components to detect aging degradation in addition to visual inspections. Physical manipulation of the elastomer component types adds a mechanism to detect change in material properties due to aging degradation. In the same August 20, 2007, letter, the applicant amended the LRA Section B.2.24 program description to add elastomeric component physical manipulations to detect aging effects. The staff finds this response acceptable. On the basis of its review, the staff finds that the aging effect of change in material properties and cracking due to various degradation mechanisms for elastomer tank diaphragm component types exposed to internal environments of treated water or an external environment of air-indoor will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-3 states that stainless steel piping, piping components, and piping elements exposed to environments of air-outdoor and stainless steel reactor makeup water storage tank component types exposed to internal or environments of air-outdoor exhibit no AERMs. The staff finds this statement acceptable because there is no indication in industry operating experience that stainless steel exposed to air-outdoor environments has any AERMs. Furthermore, the GALL Report does not indicate any AERMs for stainless steel exposed to external uncontrolled air-indoor environments.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Primary Sampling 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 primary sampling system component groups.

In LRA Table 3.3.2-4, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes that bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload of stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-4, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice and pitting corrosion for stainless steel piping, piping components, and piping elements exposed to internal environments of air/gas (wetted).

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for stainless steel piping, piping components, and piping elements exposed to internal environments of air/gas (wetted) will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-4, the applicant proposed the Water Chemistry Program to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel primary sampling cooler components exposed to internal treated water environments.

The staff's evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.1.1. During the onsite audit, the staff asked the applicant to clarify how it verifies the effectiveness of the Water Chemistry Program for this AMR. In its letter dated August 20, 2007, the applicant stated that the heat transfer intended function is preserved by the Closed-Cycle Cooling Water System Program on the external surfaces of the primary sampling cooler tubes. The staff finds this statement acceptable because the effectiveness of the Water Chemistry Program will be verified by the Closed-Cycle Cooling Water System Program and affirmed by the continual operation of the sampling system. If the heat transfer function became degraded due to aging effects, the plant staff would detect it during the sampling process. On the basis of its review, the staff finds that the aging effect of reduction of heat transfer effectiveness due to fouling of stainless steel primary sampling cooler component heat transfer surfaces exposed to internal treated water environments will be effectively managed by the Water Chemistry Program.

In LRA Table 3.3.2-4, the applicant proposed the Water Chemistry Program to manage SCC for stainless steel primary sampling cooler components exposed to internal treated water environments.

The staff's evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.1.1. The Water Chemistry Program description states that the program controls water chemistry for impurities (*e.g.*, oxygen, chlorides, fluorides, and sulfates) that accelerate corrosion and cracking. On the basis of its review, because the staff finds that the aging effect of SCC for stainless steel primary sampling cooler components exposed to internal treated water environments will be effectively managed by the Water Chemistry Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Post-Accident Sampling System - LRA Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the post-accident sampling system component groups.

In LRA Table 3.3.2-5, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload of stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-5, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice and pitting corrosion for stainless steel containment isolation piping and components and piping, piping components, and piping element component types exposed to internal air/gas (wetted) environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for stainless steel containment isolation piping and components and piping, piping components, and piping element component types exposed to internal air/gas (wetted) environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-5 states that piping thermal insulation exposed to air-indoor environments exhibits no AERMs. During the audit and review, the staff confirmed that the materials in thermal insulation include elastomeric closed cell foam, phenolic foam, calcium silicate, sodium silicate, mineral wool, glass wool, refractory fiber, rigid fibrous glass, insulation board, and fiberglass, that these insulation types similar to those elsewhere in the industry have exhibited no age-related degradation, and that plant-specific operating experience shows no aging effects for these materials. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that thermal insulation material exposed to air-indoor environments has any AERMs for its intended function.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Circulating Water 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 circulating water system component groups.

In LRA Table 3.3.2-6, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to internal raw water environments or air-indoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of the external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to internal raw water environments or air-indoor environments will be effectively managed by the External Surfaces Monitoring Program.

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).

3.3.2.3.7 Auxiliary Systems - Summary of Aging Management Evaluation - Cooling Tower 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 cooling tower system component groups.

LRA Table 3.3.2-7 states that fiber glass or fiber reinforced plastic buried piping, piping components, and piping elements exposed to raw water internal environments or soil environments exhibit no AERMs. The staff finds this statement acceptable because there is no indication in industry operating experience that fiber glass or fiber reinforced plastic exposed to raw water internal environments or soil environments have any AERMs. These materials are generally for component types exposed to untreated water or soil environments.

In LRA Table 3.3.2-7, the applicant proposed the Bolting Integrity Program to manage loss of material due to crevice, pitting, general, and microbiologically influenced corrosion and loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to raw water environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of material due to crevice, pitting, general, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to raw water environments will be effectively managed by the Bolting Integrity Program.

LRA Table 3.3.2-7 states that polyvinyl chloride (PVC) or thermoplastic piping, piping components, piping element, and spray nozzle component types exposed to both raw water internal and external environments exhibit no AERMs. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that PVC or thermoplastics exposed to raw water internal or external environments have any AERMs. These materials are generally for component types exposed to untreated water environments.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Cooling Tower Make-up System - LRA Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the cooling tower make-up system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-8 are consistent with the GALL Report.

3.3.2.3.9 Auxiliary Systems - Summary of Aging Management Evaluation - Screen Wash 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 screen wash system component groups.

In LRA Table 3.3.2-9, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to erosion for carbon or low-alloy steel fire service screen wash pumps and flow blockage due to general corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to erosion for carbon or low-alloy steel fire service screen wash pumps and flow blockage due to general corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-9, the applicant proposed the Bolting Integrity Program to manage loss of material due to crevice, pitting, general, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to raw water environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of material due to crevice, pitting, general, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to raw water environments will be effectively managed by the Bolting Integrity Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Normal Service 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 normal service water system component groups.

In LRA Table 3.3.2-10, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to erosion of carbon or low-alloy steel normal service water pumps and normal service water seal and bearing water booster pumps exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to erosion of carbon or low-alloy steel normal service water pumps and normal service water seal and bearing water booster pumps exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-10, the applicant proposed the Bolting Integrity Program to manage loss of material due to crevice, pitting, general, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to raw water environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of material due to crevice, pitting, general, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to raw water environments will be effectively managed by the Bolting Integrity Program.

LRA Table 3.3.2-10 states that stainless steel piping, piping components, and piping elements and system strainer component types exposed to air-indoor environments exhibit no AERMs. The staff finds this LRA statement acceptable because stainless steel is highly resistant to corrosion in dry atmospheres in the absence of corrosive species (which would be reflective of indoor-air), as documented in the *Metals Handbook*, Volume 3 (page 65) and Volume 13 (page 555) (Ninth Edition, American Society for Metals International, 1980 and 1987). Components are not subject to moisture in dry air environments; therefore, stainless steel in indoor-air environments 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).

3.3.2.3.11 Auxiliary Systems - Summary of Aging Management Evaluation - 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.

LRA Table 3.3.2-11 states that elastomer piping, piping components, and piping elements exposed to air/gas (dry) internal or air-indoor environments exhibit no AERMs. These materials, unlike metals, do not display corrosion rates but rely on chemical resistance to environments to which they are exposed; therefore, based on industry operating experience and the assumption of proper design and application of the material, the staff finds that elastomer piping, piping components, and piping elements exposed to air/gas (dry) internal or air-indoor environments exhibit 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.

In LRA Table 3.3.2-11, the applicant proposed the Open-Cycle Cooling Water System Program to manage loss of material due to erosion of carbon or low-alloy steel emergency service water pumps and flow blockages due to general corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Open-Cycle Cooling Water System Program is documented in SER Section 3.0.3.1.4. The Open-Cycle Cooling Water System Program description includes surveillances and control techniques to manage aging effects caused by biofouling, corrosion, erosion, and silting in open-cycle cooling water systems or structures and components serviced by such systems. On the basis of its review, because the staff finds that the aging effect of loss of material due to erosion of carbon or low-alloy steel emergency service water pumps and flow blockages due to general corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Open-Cycle Cooling Water System Program.

In LRA Table 3.3.2-11, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to external air-indoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of the external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effects of change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to external air-indoor environments will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-11, the applicant proposed the "Bolting Integrity Program to manage loss of material due to crevice, pitting, general, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to raw water environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of material due to crevice, pitting, general, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to raw water environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-11, the applicant proposed the Bolting Integrity Program to manage loss of material due to crevice, pitting, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to raw water environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of material due to crevice, pitting, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to raw water environments will be effectively managed by the Bolting Integrity Program.

LRA Table 3.3.2-11 states that stainless steel closure bolting and piping, piping components, and piping element component types exposed to air-outdoor environments exhibit no AERMs. The staff finds this LRA statement acceptable because the GALL Report indicates that there are no aging effects for stainless steel exposed to uncontrolled indoor air. Furthermore, there is no likelihood of age-related degradation for stainless steel in an air-outdoor environment without an aggressive factor like salt air or an industrial location. Stainless steel is highly resistant to corrosion in dry atmospheres in the absence of corrosive species (which would be reflective of uncontrolled indoor air), as documented in the *Metals Handbook*, Volume 3 (page 65) and Volume 13 (page 555) (Ninth Edition, American Society for Metals International, 1980 and 1987). During the onsite audit, the staff confirmed that HNP is not located near the sea nor in an industrial location; therefore, stainless steel closure bolting and piping, piping components, and piping elements in air-outdoor environments exhibit 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.

LRA Table 3.3.2-11 states that piping thermal insulation component types exposed to air-indoor environments exhibits no AERMs. During the audit and review, the staff confirmed that the materials in HNP thermal insulation include elastomeric closed cell foam, phenolic foam, calcium silicate, sodium silicate, mineral wool, glass wool, refractory fiber, rigid fibrous glass, insulation board, and fiberglass, that these insulation types similar to those elsewhere in the industry have demonstrated no age-related degradation, and that plant-specific operating experience shows no aging effects for these materials. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that thermal insulation material exposed to air-indoor environments has any AERMs for its intended function.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Component Cooling Water 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 component cooling water system component groups.

In LRA Table 3.3.2-12, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

LRA Table 3.3.2-12 states that piping thermal insulation component types exposed to air-indoor environments exhibits no AERMs. During the audit and review, the staff confirmed that the materials HNP thermal insulation include elastomeric closed cell foam, phenolic foam, calcium silicate, sodium silicate, mineral wool, glass wool, refractory fiber, rigid fibrous glass, insulation board, and fiberglass, that these insulation types similar to those elsewhere in the industry have exhibited no age-related degradation, and that plant-specific operating experience shows no aging effects for these materials. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that thermal insulation material exposed to air-indoor environments has any AERMs for its intended function.

LRA Table 3.3.2-12 states that carbon or low-alloy steel component cooling water surge tank component types exposed to external air-indoor environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for this material exposed to controlled air-indoor environments; therefore, carbon or low-alloy steel component cooling water surge tank component types exposed to external air-indoor environments exhibit 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).

3.3.2.3.13 Auxiliary Systems - Summary of Aging Management Evaluation - Waste Processing Building Cooling Water 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 waste processing building cooling water system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-13 are consistent with the GALL Report.

3.3.2.3.14 Auxiliary Systems - Summary of Aging Management Evaluation - Essential Services Chilled Water System - LRA Table 3.3.2-14

The staff reviewed LRA Table 3.3.2-14, which summarizes the results of AMR evaluations for the essential services chilled water system component groups.

In LRA Table 3.3.2-14, the applicant proposed the Lubricating Oil Analysis and One-Time Inspection Programs to manage loss of material due to galvanic corrosion for carbon or low-alloy steel essential chilled water compressor oil cooler components exposed to internal or external environments of lubricating oil or hydraulic fluid.

The staff's evaluations of the Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. The Lubricating Oil Analysis Program description states that the program maintains the oil system contaminates (primarily water and particulates) within acceptable limits by sampling to preserve an environment not conducive to loss of material. During the onsite audit, the staff asked the applicant to clarify the use of this program to manage loss of material due to galvanic corrosion.

In its letter dated August 20, 2007, the applicant stated that lubricating oil does not produce any potential aging effects due to galvanic corrosion without water contamination and pooling in contact with dissimilar metals. On the basis that the Lubricating Oil Analysis Program monitors oil quality for moisture in its samples to preserve an environment not conducive to galvanic corrosion, the staff finds this statement acceptable. In addition, the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program. On the basis of its review, the staff finds that the aging effect of loss of material due to galvanic corrosion for carbon or low-alloy steel essential chilled water compressor oil cooler components exposed to internal or external environments of lubricating oil or hydraulic fluid will be effectively managed by the Lubricating Oil Analysis and One-Time Inspection Programs.

In LRA Table 3.3.2-14, the applicant proposed the Open-Cycle Cooling Water System Program to manage loss of material due to MIC for stainless steel flow-restricting elements exposed to internal environments of treated water (for both pressure boundary and throttling intended functions).

The staff's evaluation of the Open-Cycle Cooling Water System Program is documented in SER Section 3.0.3.1.4. The Open-Cycle Cooling Water System Program description includes surveillances and control techniques to manage aging effects caused by biofouling, corrosion, erosion, and silting in open-cycle cooling water systems or structures and components serviced by such systems. On the basis of its review, the staff finds that the aging effect of loss of material due to MIC for stainless steel flow-restricting elements exposed to internal environments of treated water (for both pressure boundary and throttling intended functions) will be effectively managed by the Open-Cycle Cooling Water System Program.

In LRA Table 3.3.2-14, the applicant proposed the Open-Cycle Cooling Water System Program to manage flow blockage due to general corrosion for carbon or low-alloy steel piping, piping components, piping elements, and tanks and flow-restricting element component types exposed to raw water internal environments.

The staff's evaluation of the Open-Cycle Cooling Water System Program is documented in SER Section 3.0.3.1.4. The Open-Cycle Cooling Water System Program description includes surveillances and control techniques to manage aging effects caused by biofouling, corrosion, erosion, and silting in open-cycle cooling water systems or structures and components serviced by such systems. On the basis of its review, because the staff finds that the aging effect of flow blockage due to general corrosion for carbon or low-alloy steel piping, piping components, piping elements, and tanks and flow-restricting element component types exposed to raw water internal environments will be effectively managed by the Open-Cycle Cooling Water System Program.

In LRA Table 3.3.2-14, the applicant proposed the Closed-Cycle Cooling Water System Program to manage loss of material due to MIC for carbon, low-alloy, or stainless steel piping, piping components, piping elements, and tanks exposed to treated water internal environments.

The staff's evaluation of the Closed-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.7. The Closed-Cycle Cooling Water System Program description states that it is an effective chemistry program augmented by component testing and inspection based on "Closed Cooling Water Chemistry Guideline: Revision 1 to TR-107396, Closed Cooling Water Chemistry Guideline," EPRI, Palo Alto, CA: 2004, to maintain license renewal intended functions. On the basis of its review, because the staff finds that the aging effect of loss of material due to MIC for carbon, low-alloy, or stainless steel piping, piping components, piping elements, and tanks exposed to treated water internal environments will be effectively managed by the Closed-Cycle Cooling Water System Program.

In LRA Table 3.3.2-14, the applicant proposed the Closed-Cycle Cooling Water System Program to manage loss of material due to MIC for carbon or low-alloy steel tanks exposed to treated water internal environments.

The staff's evaluation of the Closed-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.7. The Closed-Cycle Cooling Water System Program description states that is an effective chemistry program augmented by component testing and inspection based on "Closed Cooling Water Chemistry Guideline: Revision 1 to TR-107396, Closed Cooling Water Chemistry Guideline," EPRI, Palo Alto, CA: 2004, to maintain license renewal intended functions. On the basis of its review, because the staff finds that the aging effect of loss of material due to MIC for stainless steel tanks exposed to treated water internal environments will be effectively managed by the Closed-Cycle Cooling Water System Program.

In LRA Table 3.3.2-14, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to MIC for carbon or low-alloy steel tanks exposed to air/gas (wetted) internal environments and flow blockages due to fouling for stainless steel system strainer screens/elements exposed to treated water external environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to MIC for carbon or low-alloy steel tanks exposed to air/gas (wetted) internal environments and flow blockages due to fouling for stainless steel system strainer screens/elements exposed to treated water environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-14, the applicant proposed the Selective Leaching of Materials Program to manage loss of material due to selective leaching for copper alloy greater than 15 percent zinc piping, piping components, piping elements, and tanks exposed to internal environments of lubricating oil or hydraulic fluid.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended functions for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, because the staff finds that the aging effect of loss of material due to selective leaching of copper alloy greater than 15 percent zinc piping, piping components, piping elements, and tanks exposed to internal environments of lubricating oil or hydraulic fluid will be effectively managed by the Selective Leaching of Materials Program.

In LRA Table 3.3.2-14, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for stainless steel piping, piping components, piping elements, and tanks exposed to air-indoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of the external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice corrosion for stainless steel piping, piping components, piping elements, and tanks exposed to air-indoor environments will be effectively managed by the External Surfaces Monitoring Program.

LRA Table 3.3.2-14 states that stainless steel piping, piping components, and piping elements and tanks exposed to air/gas (wetted) internal environments exhibit no AERMs. The plant-specific note for this line item indicates that this environment consists of potentially moist service air connected to the top of the essential services chiller water system surge tank with no direct connection to the chilled water and no source of contaminants like chlorides or sulfides.

The staff finds this LRA statement acceptable because stainless steel is highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as documented in the *Metals Handbook*, Volume 3 (page 65) and Volume 13 (page 555) (Ninth Edition, American Society for Metals International, 1980 and 1987); therefore, stainless steel in air/gas (wetted) internal environments 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.

LRA Table 3.3.2-14 states that glass essential chilled water system chiller cooler components exposed to air/gas (dry) internal environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report lists no aging effects for glass exposed to a range of fluid environments; therefore, glass essential chilled water system chiller cooler components exposed to air/gas (dry) internal environments exhibit 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).

3.3.2.3.15 Auxiliary Systems - Summary of Aging Management Evaluation - Non-Essential Serviced Chilled Water 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 non-essential serviced chilled water system component groups.

In LRA Table 3.3.2-15, the applicant proposed the Closed-Cycle Cooling Water System Program to manage loss of material due to MIC for carbon, low-alloy, or stainless steel piping, piping components, and piping elements exposed to treated water internal environments.

The staff's evaluation of the Closed-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.7. The Closed-Cycle Cooling Water System Program description states that it is an effective chemistry program augmented by component testing and inspection based on "Closed Cooling Water Chemistry Guideline: Revision 1 to TR-107396, Closed Cooling Water Chemistry Guideline," EPRI, Palo Alto, CA: 2004, to maintain license renewal intended functions. On the basis of its review, because the staff finds that the aging effect of loss of material due to MIC for carbon, low-alloy, or stainless steel piping, piping components, and piping elements exposed to treated water internal environments will be effectively managed by the Closed-Cycle Cooling Water System Program.

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).

3.3.2.3.16 Auxiliary Systems - Summary of Aging Management Evaluation - Emergency Screen Wash 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 emergency screen wash system component groups.

In LRA Table 3.3.2-16, the applicant proposed the Open-Cycle Cooling Water System Program to manage flow blockage due to general corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Open-Cycle Cooling Water System Program is documented in SER Section 3.0.3.1.4. The Open-Cycle Cooling Water System Program description includes surveillances and control techniques to manage aging effects caused by biofouling, corrosion, erosion and silting in open-cycle cooling water systems or structures and components serviced by such systems. In addition, the plant-specific note for this line item states that flushing or replacement of these piping sections is included in the Open-Cycle Cooling Water System Program. On the basis of its review, because the staff finds that the aging effect of flow blockage due to general corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Open-Cycle Cooling Water System Program.

In LRA Table 3.3.2-16, the applicant proposed the Bolting Integrity Program to manage loss of material due to crevice, pitting, and general corrosion and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to raw water environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of material due to crevice, pitting, and general corrosion and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to raw water environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-16, the applicant proposed the "Bolting Integrity Program to manage loss of material due to crevice and pitting corrosion and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to raw water environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of material due to crevice, pitting corrosion, and MIC and loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to raw water environments will be effectively managed by the Bolting Integrity Program.

LRA Table 3.3.2-16 states that piping thermal insulation component types exposed to air-indoor environments exhibit no AERMs. During the audit and review, the staff confirmed that the materials in HNP thermal insulation include elastomeric closed cell foam, phenolic foam, calcium silicate, sodium silicate, mineral wool, glass wool, refractory fiber, rigid fibrous glass, insulation board, and fiberglass, that these insulation types similar to those elsewhere in the industry have exhibited no age-related degradation, and that plant-specific operating experience shows no aging effects for these materials. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that thermal insulation material exposed to air-indoor environments has any AERMs for its intended function.

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).

3.3.2.3.17 Auxiliary Systems - Summary of Aging Management Evaluation - Emergency Diesel Generator 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 emergency diesel generator system component groups.

LRA Table 3.3.2-17 states that copper alloy greater than 15 percent zinc diesel engine turbocharger intercooler components exposed to air/gas (wetted) external environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy greater than 15 percent zinc component types exposed to air with borated water leakage, a harsher environment; therefore, copper alloy greater than 15 percent zinc diesel engine turbocharger intercooler components exposed to air/gas (wetted) environments exhibit 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.

In LRA Table 3.3.2-17, the applicant proposed a TLAA to manage cracking due to thermal fatigue for carbon, low-alloy, or stainless steel diesel combustion air intake piping, piping components, and piping elements exposed to air/gas (wetted) internal environments.

The staff evaluation of the TLAA is documented in SER Section 4.3.

In LRA Table 3.3.2-17, the applicant proposed a TLAA to manage cracking due to thermal fatigue for carbon or low alloy or stainless steel piping, piping components, and piping elements exposed to diesel exhaust internal environment.

The staff evaluation of the TLAA is documented in SER Section 4.3.

In LRA Table 3.3.2-17, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to pitting and crevice corrosion for stainless steel diesel combustion air intake piping, piping components, and piping elements exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to pitting and crevice corrosion for stainless steel diesel combustion air intake piping, piping components, and piping elements exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-17, the applicant proposed the "Selective Leaching of Materials Program to manage loss of material due to selective leaching for copper alloy greater than 15 percent zinc diesel engine governor oil cooler components exposed to internal environments of lubricating oil or hydraulic fluid.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended functions for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, because the staff finds that the aging effect of loss of material due to selective leaching of copper alloy greater than 15 percent zinc diesel engine governor oil cooler components exposed to internal environments of lubricating oil or hydraulic fluid will be effectively managed by the Selective Leaching of Materials Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Diesel Generator Fuel Oil Storage and Transfer 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 diesel generator fuel oil storage and transfer system component groups.

LRA Table 3.3.2-18 states that stainless steel fuel oil tank flame arresters exposed to air/gas (wetted) internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as documented in the *Metals Handbook*, Volume 3 (page 65) and Volume 13 (page 555) (Ninth Edition, American Society for Metals International, 1980 and 1987); therefore, stainless steel in this air/gas (wetted) internal 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.

In LRA Table 3.3.2-18, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel fuel oil tank flame arrester elements exposed to air/gas (wetted) environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to pitting and crevice corrosion for stainless steel fuel oil tank flame arrester elements exposed to air/gas (wetted) external environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Diesel Generator Lubrication 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 diesel generator lubrication system component groups.

LRA Table 3.3.2-19 states that copper alloy greater than 15 percent zinc lube oil cooler components exposed to treated water internal environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy greater than 15 percent zinc component types exposed to air with borated water leakage, a harsher environment than treated water; therefore, copper alloy greater than 15 percent zinc lube oil cooler components exposed to treated water internal environments exhibit 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.

In LRA Table 3.3.2-19, the applicant proposed the Lubricating Oil Analysis and One-Time Inspection Programs to manage SCC for stainless steel flow restricting elements and piping,

piping components, and piping elements and stainless steel system strainer screens/elements exposed to environments of lubricating oil or hydraulic fluid.

The staff's evaluations of the Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. The Lubricating Oil Analysis Program description states that the program maintains the oil system contaminates (primarily water and particulates) within acceptable limits by sampling to preserve an environment not conducive to SCC. On the basis that the Lubricating Oil Analysis Program maintains water contamination within acceptable limits, the staff finds the applicant's proposal acceptable. In addition, the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program. On the basis of its review, the staff finds that the aging effect of SCC for stainless steel flow restricting elements and piping, piping components, and piping elements exposed to internal environments of lubricating oil or hydraulic fluid and stainless steel system strainer screens/elements exposed to environments of lubricating oil or hydraulic fluid will be effectively managed by the Lubricating Oil Analysis and One-Time Inspection Programs.

LRA Table 3.3.2-19 states that carbon or low-alloy steel piping, piping components, and piping elements exposed to lubricating oil or hydraulic fluid internal environments exhibit no AERMs. During the onsite audit, the staff asked the applicant for the specific component or components addressed in this line item.

In its letter dated August 20, 2007, the applicant stated that this line represents an immersion heater configured in the tank not to come in contact with water in the event of contamination or pooling. The staff finds this statement acceptable because without the presence of water this component type would exhibit no AERMs; therefore, carbon or low-alloy steel piping, piping components, and piping elements exposed to lubricating oil or hydraulic fluid internal environments exhibit no aging effects, 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).

3.3.2.3.20 Auxiliary Systems - Summary of Aging Management Evaluation - Diesel Generator Cooling Water 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 diesel generator cooling water system component groups.

LRA Table 3.3.2-20 states that copper alloy greater than 15 percent zinc jacket water cooler components exposed to treated water external environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy greater than 15 percent zinc component types exposed to air with borated water leakage, an environment more aggressive than the treated water external environment in this line item;

therefore, copper alloy greater than 15 percent zinc jacket water cooler components exposed to treated water external environments exhibit no aging effects, 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).

3.3.2.3.21 Auxiliary Systems - Summary of Aging Management Evaluation - Diesel Generator Air Starting 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 diesel generator air starting system component groups.

LRA Table 3.3.2-21 states that copper alloy less than 15 percent zinc piping, piping components, and piping elements exposed to air/gas (wetted) internal environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy less than 15 percent zinc component types exposed to air with borated water leakage, an environment more aggressive than the air/gas (wetted) internal environment in this line item; therefore, copper alloy less than 15 percent zinc piping, piping components, and piping elements exposed to air/gas (wetted) internal environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

In LRA Table 3.3.2-21, the applicant proposed the Selective Leaching of Materials Program to manage loss of material due to selective leaching for copper alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended functions for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, because the staff finds that the aging effect of loss of material due to selective leaching of copper alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to air/gas (wetted) internal environments will be effectively managed by the Selective Leaching of Materials Program.

In LRA Table 3.3.2-21, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to pitting and crevice corrosion for carbon or low-alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to pitting and crevice corrosion for carbon or low-alloy steel greater than 15 percent zinc piping, piping components, and piping elements exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-21, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage SCC and loss of material due to pitting and crevice corrosion for stainless steel piping, piping components, and piping elements exposed to air/gas (wetted) internal environments and stainless steel system strainer screens/elements exposed to air/gas (wetted) environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effects of SCC and loss of material due to pitting and crevice corrosion for stainless steel piping, piping components, and piping elements exposed to air/gas (wetted) internal environments and stainless steel system strainer screens/elements exposed to air/gas (wetted) external environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Security Power 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 security power system component groups.

In LRA Table 3.3.2-22, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to external air-indoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of the external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effects of change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to external air-indoor environments will be effectively managed by the External Surfaces Monitoring Program.

LRA Table 3.3.2-22 states that elastomers, PVC or thermoplastic piping, piping components, and piping elements exposed to internal fuel oil environments exhibit no AERMs. These materials, unlike metals, do not display corrosion rates but rely on chemical resistance to environments to which they are exposed; therefore, based on industry operating experience and the assumption of proper design and application of the material, the staff finds that elastomers, PVC or thermoplastic piping, piping components, and piping elements exposed to internal fuel oil environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-22 states that elastomer piping, piping components, and piping elements exposed to air/gas (wetted) environments exhibit no AERMs. This commodity group consists of the fuel oil hoses connecting sections of the fuel oil supply and return line that transfers oil between the main, buried storage, and fuel oil day tanks. The selected environment represents conditions in this space, cool and damp. The staff finds this LRA statement acceptable because industry operating experience shows no aging effects likely for this material and environment combination; therefore, elastomer piping, piping components, and piping elements exposed to air/gas (wetted) environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-22 states that PVC or thermoplastic piping, piping components, and piping elements exposed to air-indoor environments exhibit no AERMs. PVC or thermoplastics, unlike metals, do not display corrosion rates but rely on chemical resistance to environments to which they are exposed. On this basis, the staff finds that PVC or thermoplastic piping, piping components, and piping elements exposed to air-indoor environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

In LRA Table 3.3.2-22, the applicant proposed the Selective Leaching of Materials Program to manage loss of material due to selective leaching for copper alloy greater than 15 percent zinc fuel oil system transfer pumps and piping, piping components, and piping elements exposed to fuel oil internal environments.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended functions for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, because the staff finds that the aging effect of loss of material due to selective leaching of copper alloy greater than 15 percent zinc fuel oil system transfer pumps and piping, piping components, and piping elements exposed to fuel oil internal environments will be effectively managed by the Selective Leaching of Materials Program.

LRA Table 3.3.2-22 states that aluminum or aluminum alloy fuel oil tank flame arresters exposed to either internal air/gas (wetted) or air-outdoor environments exhibit no AERMs. Aluminum has an excellent resistance to corrosion when exposed to humid air (outdoor or moist air/gas environment). The aluminum oxide film bonds strongly to its surface and, if damaged, reforms immediately in most environments. 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, the staff finds that aluminum or aluminum alloy fuel oil tank flame arresters exposed to either internal air/gas (wetted) or air-outdoor environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

In LRA Table 3.3.2-22, the applicant proposed the Lubricating Oil Analysis and One-Time Inspection Programs to manage SCC for stainless steel lube oil cooler components exposed to environments of lubricating oil or hydraulic fluid.

The staff's evaluations of the Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively. The Lubricating Oil Analysis Program description states that the program maintains oil system contaminates (primarily water and particulates) within acceptable limits by sampling to preserve an environment not conducive to SCC. On the basis that the Lubricating Oil Analysis Program maintains water contamination within acceptable limits, the staff finds the applicant's proposal acceptable. In addition, the One-Time Inspection Program verifies the effectiveness of the Lubricating Oil Analysis Program. On the basis of its review, the staff finds that the aging effect of SCC for stainless steel lube oil cooler components exposed to environments of lubricating oil or hydraulic fluid will be effectively managed by the Lubricating Oil Analysis and One-Time Inspection Programs.

In LRA Table 3.3.2-22, the applicant proposed the Selective Leaching of Materials Program to manage loss of material due to selective leaching for copper alloy greater than 15 percent zinc lube oil cooler components and piping, piping components, and piping elements and gray cast-iron piping, piping components, and piping elements exposed to fuel oil internal environments.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended functions for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, because the staff finds that the aging effect of loss of material due to selective leaching of copper alloy greater than 15 percent zinc lube oil cooler components and piping, piping components, and piping elements and gray cast-iron piping, piping components, and piping elements exposed to fuel oil internal environments will be effectively managed by the Selective Leaching of Materials Program.

In LRA Table 3.3.2-22, the applicant proposed the Closed-Cycle Cooling Water System Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy radiator components exposed to treated water internal environments.

The staff's evaluation of the Closed-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.7. The Closed-Cycle Cooling Water System Program description states that it is an effective chemistry program augmented by component testing and inspection based on "Closed Cooling Water Chemistry Guideline: Revision 1 to TR-107396, Closed Cooling Water Chemistry Guideline," EPRI, Palo Alto, CA: 2004, to maintain license renewal intended functions. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy radiator components exposed to treated water internal environments will be effectively managed by the Closed-Cycle Cooling Water System Program.

In LRA Table 3.3.2-22, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to internal fuel oil environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of the external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. The plant-specific note for this line item indicates that this commodity group consists of elastomer hoses. The aging effects for such hoses are driven more by temperature than the environment to which they are exposed; therefore, the external surface is a reasonable indicator of aging effects on internal surfaces and the External Surfaces Monitoring Program is a reasonable approach. On the basis of its review, because the staff finds that the aging effect of change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to internal fuel oil environments will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-22, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for aluminum or aluminum alloy or stainless steel fuel oil tank flame arrester elements exposed to air/gas (wetted) environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The plant-specific note for this line item indicates that the flame arrester requires periodic cleaning to function properly. On the basis of its review, because the staff finds that the aging effect of reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for aluminum or aluminum alloy or stainless steel fuel oil tank flame arrester elements exposed to air/gas (wetted) external environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-22 states that fiberglass or fiber-reinforced plastic buried tanks exposed to soil environments exhibit no AERMs. Fiberglass or fiber-reinforced plastic, unlike metals, do not display corrosion rates and rely on chemical resistance to environments to which they are exposed. On this basis, the staff finds that fiberglass or fiber-reinforced plastic buried tanks exposed to soil environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

In LRA Table 3.3.2-22, the applicant proposed a TLAA to manage cracking due to thermal fatigue for carbon or low-alloy steel piping, piping components, and piping elements (diesel engine exhaust) exposed to diesel exhaust internal environments.

The staff evaluation of the TLAA is documented in SER Section 4.3.

In LRA Table 3.3.2-22, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer diesel combustion air intake piping, piping components, and piping elements exposed to air/gas (wetted) internal or air-indoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. The plant-specific note for this line item indicates that this commodity group consists of elastomer hoses. The aging effects for such hoses are driven more by temperature than the environments to which they are exposed; therefore, the external surface is a reasonable indicator of aging effects on the internal surfaces and the External Surfaces Monitoring Program is a reasonable approach. On the basis of its review, the staff finds that the aging effects of change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to internal fuel oil environments will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-22, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer seals and components exposed to fuel oil, lubricating oil, or hydraulic fluid internal environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. The plant-specific note for this line item indicates that this commodity group consists of elastomer hoses. The aging effects for these elastomer hoses are driven more by temperature than the environments to which they are exposed; therefore, the external surface is a reasonable indicator of aging effects on internal surfaces and the External Surfaces Monitoring Program is a reasonable approach. On the basis of its review, the staff finds that the aging effects of change in material properties and cracking due to various degradation mechanisms for elastomer seals and components exposed to fuel oil, lubricating oil, or hydraulic fluid internal environments will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-22, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer seals and components exposed to air-indoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of change in material properties and cracking due to various degradation mechanisms for elastomer seals and components exposed to air-indoor environments will be effectively managed by the External Surfaces Monitoring Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Instrument Air 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 instrument air system component groups.

In LRA Table 3.3.2-23, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effects of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Service Air 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 service air 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 Auxiliary Systems - Summary of Aging Management Evaluation - Bulk Nitrogen Storage 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 bulk nitrogen storage system component groups.

In LRA Table 3.3.2-25, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Hydrogen Gas 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 hydrogen gas system component groups.

In LRA Table 3.3.2-26, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Fire Protection 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 fire protection system component groups.

In LRA Table 3.3.2-27, the applicant proposed the Fire Water System Program to manage loss of material due to crevice and pitting corrosion and MIC for copper alloy greater than 15 percent zinc piping, piping components, and piping elements and sprinkler heads exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Fire Water System Program is documented in SER Section 3.0.3.2.11. The Fire Water System Program description includes system pressure monitoring, wall thickness evaluations, periodic flow and pressure testing in accordance with applicable National Fire Protection Association commitments, and periodic visual inspection of overall system condition. These activities determine whether corrosion and biofouling occur. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion and MIC for copper alloy greater than 15 percent zinc piping, piping components, and piping elements and sprinkler heads exposed to air/gas (wetted) internal environments will be effectively managed by the Fire Water System Program.

In LRA Table 3.3.2-27, the applicant proposed the Fire Water System Program to manage loss of material due to crevice, general, and pitting corrosion and MIC for gray cast-iron piping, piping components, and piping elements exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Fire Water System Program is documented in SER Section 3.0.3.2.11. The Fire Water System Program description includes system pressure monitoring, wall thickness evaluations, periodic flow and pressure testing in accordance with applicable National Fire Protection Association commitments, and periodic visual inspection of overall system condition. These activities determine whether corrosion and biofouling occur. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice, general, and pitting corrosion and MIC for gray cast-iron piping, piping components, and piping elements exposed to air/gas (wetted) internal environments will be effectively managed by the Fire Water System Program.

In LRA Table 3.3.2-27, the applicant proposed the Selective Leaching of Materials Program to manage loss of material due to selective leaching for copper alloy greater than 15 percent zinc and gray cast-iron piping, piping components, and piping elements and copper alloy greater than 15 percent zinc sprinkler heads exposed to air/gas (wetted) internal environments or copper alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to lubricating oil or hydraulic fluid internal environments.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended functions for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, because the staff finds that the aging effect of loss of material due to selective leaching of copper alloy greater than 15 percent zinc and gray cast-iron piping, piping components, and piping elements and copper alloy greater than 15 percent zinc sprinkler heads exposed to air/gas (wetted) internal environments or copper alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to lubricating oil or hydraulic fluid internal environments will be effectively managed by the Selective Leaching of Materials Program.

LRA Table 3.3.2-27 states that aluminum or aluminum alloy heat exchanger components exposed to air-outdoor environments exhibit no AERMs. Aluminum has an excellent resistance to corrosion when exposed to humid air (air-outdoor environment). The aluminum oxide film bonds strongly to its surface and, if damaged, reforms immediately in most environments. 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, the staff finds that aluminum or aluminum alloy heat exchanger components exposed to air-outdoor environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

In LRA Table 3.3.2-27, the applicant proposed the Fire Protection and Fuel Oil Chemistry Programs to manage loss of material due to MIC for carbon or low-alloy steel piping, piping components, and piping elements exposed to fuel oil internal environments.

The staff's evaluations of the Fire Protection and Fuel Oil Chemistry Programs are documented in SER Sections 3.0.3.2.10 and 3.0.3.2.12, respectively. The Fire Protection Program description states that the program manages aging of the diesel-driven fire pump fuel oil supply lines and fire barrier assemblies including fire doors, penetration seals, fire wrap, barrier walls, barrier ceilings and floors, and seismic joint filler. The effective Fire Protection Program will adequately manage cracking and loss of material. The Fuel Oil Chemistry Program description states that the program maintains fuel oil quality by monitoring and controlling fuel oil contamination in accordance with ASTM standards. The program minimizes exposure to fuel oil contaminants (*e.g.*, water and microbiological organisms) by verifying the quality of new oil and adding stabilizers before its introduction into the storage tanks and by periodic sampling for whether the tanks are free of water, particulates, and biological growth. During the onsite audit, the staff noted that the Fuel Oil Chemistry Program added stabilizers with a biocide. In its letter dated August 20, 2007, the applicant amended the LRA to include the following:

> Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by verifying the quality of new oil and the addition of a stabilizer, which contains a biocide and corrosion inhibitors, before the fuel oil is added to the storage tanks that supply the Emergency Diesel Generator and Security Power Diesel Generator. Continued quality levels are assured by periodically checking for and removing water from tank drains, sampling to confirm that the bulk properties of water and sediment, particulate contamination, and biological growth are within administrative target values or Technical Specification limits.

The plant-specific note for this line item indicates that the Fuel Oil Chemistry Program addresses the possibility of loss of material due to MIC. On the basis of its review, because the staff finds that the aging effect of loss of material due to MIC in carbon or low-alloy steel piping, piping components, and piping elements exposed to fuel oil internal environments will be effectively managed by the Fire Protection and Fuel Oil Chemistry Programs.

In LRA Table 3.3.2-27, the applicant proposed the Fire Water System Program to manage loss of material due to MIC for stainless steel containment isolation piping, piping components, piping elements, and system strainer screens/elements and aluminum or aluminum alloy piping, piping components, and piping elements exposed to internal raw water environments.

The staff's evaluation of the Fire Water System Program is documented in SER Section 3.0.3.2.11. The Fire Water System Program description states that the program includes system pressure monitoring, wall thickness evaluations, periodic flow and pressure testing in accordance with applicable National Fire Protection Association commitments, and periodic visual inspection of overall system condition. These activities determine whether corrosion and biofouling occur. On the basis of its review, because the staff finds that the aging effect of loss of material due to MIC for stainless steel containment isolation piping, piping components, piping elements, and system strainer screens/elements and aluminum or aluminum alloy piping, piping components, and piping elements exposed to internal raw water environments will be effectively managed by the Fire Water System Program.

In LRA Table 3.3.2-27, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to MIC for carbon or low-alloy steel piping, piping components, and piping elements exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, the staff finds that the aging effect of loss of material due to MIC for carbon or low-alloy steel piping, piping components, and piping elements exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-27, the applicant proposed the Selective Leaching of Materials Program to manage loss of material due to selective leaching for copper alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to fuel oil internal environments.

The staff's evaluation of the Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.14. The Selective Leaching of Materials Program description states that examinations will determine whether selective leaching has occurred and whether the process affects component ability to perform intended functions for the period of extended operation. This new program is consistent with GALL AMP XI.M33, "Selective Leaching," with an exception to the Brinell hardness test. An acceptable alternative examination method will not affect the ability of the applicant's program to detect selective leaching. On the basis of its review, because the staff finds that the aging effect of loss of material due to selective leaching of copper alloy greater than 15 percent zinc piping, piping components, and piping elements exposed to fuel oil internal environments will be effectively managed by the Selective Leaching of Materials Program.

In LRA Table 3.3.2-27, the applicant proposed the Closed-Cycle Cooling Water System Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy heat exchanger components exposed to treated water internal environments.

The staff's evaluation of the Closed-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.7. The Closed-Cycle Cooling Water System Program description states that it is an effective chemistry program augmented by component testing and inspection based on "Closed Cooling Water Chemistry Guideline: Revision 1 to TR-107396, Closed Cooling Water Chemistry Guideline," EPRI, Palo Alto, CA: 2004, to maintain license renewal intended functions. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy heat exchanger components exposed to treated water internal environments will be effectively managed by the Closed-Cycle Cooling Water System Program.

In LRA Table 3.3.2-27, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to internal environments of either treated water, fuel oil, lubricating oil, or hydraulic fluid.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. The plant-specific note for this line item indicates that this commodity group consists of elastomer hoses. The aging effects for these elastomer hoses are driven more by temperature than the environments to which they are exposed; therefore, the external surface is a reasonable indicator of aging effects on the internal surfaces and the External Surfaces Monitoring Program is a reasonable approach. On the basis of its review, because the staff finds that the aging effects of change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to internal environments of either treated water, fuel oil, lubricating oil, or hydraulic fluid will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-27, the applicant proposed the External Surfaces Monitoring Program to manage change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to air-indoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effects of change in material properties and cracking due to various degradation mechanisms for elastomer piping, piping components, and piping elements exposed to air-indoor environments will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-27, the applicant proposed the Fire Water System Program to manage loss of material due to galvanic corrosion and MIC for aluminum or aluminum alloy heat exchanger components and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for copper alloy less than 15 percent zinc heat exchanger tubes exposed to internal raw water environments.

The staff's evaluation of the Fire Water System Program is documented in SER Section 3.0.3.2.11. The Fire Water System Program description states that the program includes system pressure monitoring, wall thickness evaluations, periodic flow and pressure testing in accordance with applicable National Fire Protection Association commitments, and periodic visual inspection of overall system condition. These activities determine whether corrosion and biofouling occur. On the basis of its review, because the staff finds that the aging effects of loss of material due to galvanic and MIC for aluminum or aluminum alloy heat exchanger components and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for copper alloy less than 15 percent zinc heat exchanger tubes exposed to internal raw water environments will be effectively managed by the Fire Water System Program.

In LRA Table 3.3.2-27, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel filters exposed to lubricating oil or hydraulic fluid internal environments, reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel fuel oil tank flame arrester elements exposed to air/gas (wetted) environments, and loss of material due to crevice and pitting corrosion for stainless steel fuel oil tank flame arresters and piping, piping components, and piping elements exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel filters exposed to lubricating oil or hydraulic fluid internal environments, reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel fuel oil tank flame arrester elements exposed to air/gas (wetted) environments, loss of material due to crevice and pitting corrosion for stainless steel fuel oil tank flame arresters and piping, piping components, and piping elements exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-27, the applicant proposed a TLAA to manage cracking due to thermal fatigue for carbon or low alloy piping, piping components, and piping elements (diesel engine exhaust) exposed to a diesel exhaust internal environment and for carbon or low alloy piping, piping components, and piping elements exposed to lubricating oil or hydraulic fluid internal environments.

The staff evaluation of the TLAA is documented in SER Section 4.3.

LRA Table 3.3.2-27 states that PVC or thermoplastic piping, piping components, and piping elements exposed to lubricating oil or hydraulic fluid internal environments exhibit no AERMs. PVC or thermoplastics, unlike metals, do not display corrosion rates and rely on chemical resistance to environments to which they are exposed. On this basis, the staff finds that PVC or thermoplastic piping, piping components, and piping elements exposed to lubricating oil or hydraulic fluid internal environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-27 states that copper alloy greater than 15 percent zinc spray nozzles exposed to air-indoor internal or air-outdoor environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy less than

15 percent zinc component types exposed to air with borated water leakage, an environment more aggressive than the environments in this line item; therefore, copper alloy less than 15 percent zinc spray nozzles exposed to air-indoor internal or air-outdoor environments exhibit no aging effects, 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).

3.3.2.3.28 Auxiliary Systems - Summary of Aging Management Evaluation - Storm Drains 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 storm drains system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-28 are consistent with the GALL Report.

3.3.2.3.29 Auxiliary Systems - Summary of Aging Management Evaluation - Oily Drains 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 oily drains system component groups.

In LRA Table 3.3.2-29, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to air-outdoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for carbon or low-alloy steel closure bolting exposed to air-outdoor environments will be effectively managed by the Bolting Integrity Program.

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).

3.3.2.3.30 Auxiliary Systems - Summary of Aging Management Evaluation - Radioactive Floor Drains 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 radioactive floor drains system component groups.

In LRA Table 3.3.2-30, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-30, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage SCC and loss of material due to MIC for stainless steel piping, piping components, piping elements, system strainers, and tanks exposed to raw water internal environments and loss of material due to MIC for stainless steel system strainers exposed to raw water environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effects of SCC and loss of material due to MIC for stainless steel piping, piping components, and piping elements, system strainers, and tanks exposed to raw water internal environments and loss of material due to MIC for stainless steel system strainers exposed to raw water environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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 Auxiliary Systems - Summary of Aging Management Evaluation - Radioactive Equipment Drains 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 radioactive equipment drains system component groups.

In LRA Table 3.3.2-31, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-31, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage SCC for stainless steel piping, piping components, piping elements, tanks, and reactor coolant drain tank heat exchanger components and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel reactor coolant drain tank heat exchanger tubes exposed to treated water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effects of SCC for stainless steel piping, piping components, piping elements, tanks, and reactor coolant drain tank heat exchanger components and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel reactor coolant drain tank heat exchanger tubes exposed to treated water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-31 states that stainless steel piping, piping components, piping elements, and tanks exposed to silicone internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species and silicone does not react with stainless steel; therefore, stainless steel piping, piping components, piping elements, and tanks exposed to silicone internal environments exhibit no aging effects, 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).

3.3.2.3.32 Auxiliary Systems - Summary of Aging Management Evaluation - Secondary Waste 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 secondary waste system component groups.

In LRA Table 3.3.2-32, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to MIC for stainless steel piping, piping components, piping elements, and tanks exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to MIC for stainless steel piping, piping components, piping elements, and tanks exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-32 states that PVC or thermoplastic piping, piping components, piping elements, and tanks exposed to either raw water internal or air-indoor environments exhibit no AERMs. PVC or thermoplastics, unlike metals, do not display corrosion rates and rely on chemical resistance to environments to which they are exposed. On this basis, the staff finds that PVC or thermoplastic piping, piping components, and piping elements exposed to either raw water internal or air-indoor environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-32 states that ceramic piping, piping components, piping elements, and tanks exposed to either raw water internal or air-indoor environments exhibit no AERMs. Ceramics are very resistant to corrosion and generally have very high meting points. Ceramic materials are similar to glass, which the staff treats as exhibiting no aging effects in such environments. On this basis, the staff finds that ceramic piping, piping components, and piping elements exposed to either raw water internal or air-indoor environments exhibit no aging effects, 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).

3.3.2.3.33 Auxiliary Systems - Summary of Aging Management Evaluation - Laundry and Hot Shower System - LRA Table 3.3.2-33

The staff reviewed LRA Table 3.3.2-33, which summarizes the results of AMR evaluations for the laundry and hot shower system component groups.

In LRA Table 3.3.2-33, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-33, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to MIC for stainless steel fuel-handling building detergent drain sump pumps, reactor auxiliary building detergent drain sump pumps and system strainers exposed to either raw water internal or external environments, stainless steel waste-processing building laundry and hot shower tanks, and fuel-handling building decontamination receiving and transfer tanks exposed to raw water internal environments.

The staff's evaluation of the Inspection of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, becthe staff finds that the aging effect of loss of material due to MIC for stainless steel fuel-handling building detergent drain sump pumps, reactor auxiliary building detergent drain sump pumps and system strainers exposed to either raw water internal or external environments, stainless steel waste-processing building laundry and hot shower tanks, and fuel-handling building decontamination receiving and transfer tank exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.34 Auxiliary Systems - Summary of Aging Management Evaluation - Upflow Filter System - LRA Table 3.3.2-34

The staff reviewed LRA Table 3.3.2-34, which summarizes the results of AMR evaluations for the upflow filter system component groups.

In LRA Table 3.3.2-34, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to erosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, the staff finds that the aging effect of loss of material due to erosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.35 Auxiliary Systems - Summary of Aging Management Evaluation - Potable and Sanitary Water System - LRA Table 3.3.2-35

The staff reviewed LRA Table 3.3.2-35, which summarizes the results of AMR evaluations for the potable and sanitary water system component groups.

In LRA Table 3.3.2-35, the applicant proposed the Inspection of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice, general, galvanic, and pitting corrosion and MIC for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, the staff finds that the aging effect of loss of material due to crevice, general, galvanic, and pitting corrosion and MIC for carbon or low-alloy steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-35, the applicant proposed the One-Time Inspection Program to manage loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel or gray cast-iron piping, piping components, and piping elements and loss of material due to crevice and pitting corrosion for copper alloy greater than 15 percent zinc or stainless steel piping, piping components, and piping elements exposed to treated water internal environments.

The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.5. The One-Time Inspection Program description includes one-time inspections to verify the absence or slow progression of an aging effect. The staff noted that the applicant has included the potable and sanitary water system within the scope of the One-Time Inspection Program to confirm that the aging effect of loss of material due to corrosion either is absent or progresses very slowly. In addition the staff confirmed that the system components are exposed to relatively benign environments. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel or gray cast-iron piping, piping components, and piping elements and loss of material due to crevice and pitting corrosion for copper alloy greater than 15 percent zinc or stainless steel piping, piping components, and piping elements exposed to treated water internal environments will be effectively managed by the One-Time Inspection Program.

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).

3.3.2.3.36 Auxiliary Systems - Summary of Aging Management Evaluation - Demineralized Water System - LRA Table 3.3.2-36

The staff reviewed LRA Table 3.3.2-36, which summarizes the results of AMR evaluations for the demineralized water system component groups.

In LRA Table 3.3.2-36, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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).

3.3.2.3.37 Auxiliary Systems - Summary of Aging Management Evaluation - Filter Backwash System - LRA Table 3.3.2-37

The staff reviewed LRA Table 3.3.2-37, which summarizes the results of AMR evaluations for the filter backwash system component groups.

In LRA Table 3.3.2-37, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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).

3.3.2.3.38 Auxiliary Systems - Summary of Aging Management Evaluation - Radiation Monitoring System - LRA Table 3.3.2-38

The staff reviewed LRA Table 3.3.2-38, which summarizes the results of AMR evaluations for the radiation monitoring system component groups.

In LRA Table 3.3.2-38, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage flow blockage due to dust buildup for stainless steel flow straighteners exposed to air-indoor internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of flow blockage due to dust buildup for stainless steel flow straighteners exposed to air-indoor internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-38, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice and pitting corrosion and MIC for stainless steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion and MIC for stainless steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.39 Auxiliary Systems - Summary of Aging Management Evaluation - Oily Waste Collection and Separation System - LRA Table 3.3.2-39

The staff reviewed LRA Table 3.3.2-39, which summarizes the results of AMR evaluations for the oily waste collection and separation system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-39 are consistent with the GALL Report.

3.3.2.3.40 Auxiliary Systems - Summary of Aging Management Evaluation - Liquid Waste Processing System - LRA Table 3.3.2-40

The staff reviewed LRA Table 3.3.2-40, which summarizes the results of AMR evaluations for the liquid waste processing system component groups.

In LRA Table 3.3.2-40, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-40, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage SCC and loss of material due to MIC for stainless steel piping, piping components, piping elements, and liquid waste holdup tank component types exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, the staff finds that the aging effects of SCC and loss of material due to MIC for stainless steel piping, piping components, piping elements, and liquid waste holdup tank component types exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.41 Auxiliary Systems - Summary of Aging Management Evaluation - Secondary Waste Treatment System - LRA Table 3.3.2-41

The staff reviewed LRA Table 3.3.2-41, which summarizes the results of AMR evaluations for the secondary waste treatment system component groups.

In LRA Table 3.3.2-41, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-41, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage SCC and loss of material due to MIC for stainless steel piping, piping components, piping elements, and tanks exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effects of SCC and loss of material due to MIC for stainless steel piping, piping components, piping elements, and tanks exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.42 Auxiliary Systems - Summary of Aging Management Evaluation - Boron Recycle System - LRA Table 3.3.2-42

The staff reviewed LRA Table 3.3.2-42, which summarizes the results of AMR evaluations for the boron recycle system component groups.

In LRA Table 3.3.2-42, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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).

3.3.2.3.43 Auxiliary Systems - Summary of Aging Management Evaluation - Gaseous Waste Processing System - LRA Table 3.3.2-43

The staff reviewed LRA Table 3.3.2-43, which summarizes the results of AMR evaluations for the gaseous waste processing system component groups.

In LRA Table 3.3.2-43, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, because the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-43, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice corrosion for carbon or low-alloy steel containment isolation piping, piping components, piping elements, and tanks and SCC for stainless steel piping, piping components, piping elements, and tanks exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice corrosion for carbon or low-alloy steel containment isolation piping, piping components, piping elements, and tanks and SCC for stainless steel piping, piping components, piping elements, and tanks exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-43, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to general and pitting corrosion for carbon or low-alloy steel containment isolation piping, piping components, piping elements, and tanks and loss of material due to crevice and pitting corrosion for stainless steel piping, piping components, piping elements, and tanks exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effects of loss of material due to general and pitting corrosion for carbon or low-alloy steel containment isolation piping, piping components, piping elements, and tanks and loss of material due to crevice and pitting corrosion for stainless steel piping, piping components, piping elements, and tanks exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-43 states that piping thermal insulation component types exposed to external air-indoor environments exhibit no AERMs. During the audit and review, the staff confirmed that the materials in HNP thermal insulation include elastomeric closed cell foam, phenolic foam, calcium silicate, sodium silicate, mineral wool, glass wool, refractory fiber, rigid fibrous glass, insulation board, and fiberglass, that these insulation types similar to those elsewhere in the industry have exhibited no age-related degradation, and that plant-specific operating experience shows no aging effects for these materials. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that thermal insulation material exposed to air-indoor environments has any AERMs for its intended function.

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).

3.3.2.3.44 Auxiliary Systems - Summary of Aging Management Evaluation - Radwaste Sampling System - LRA Table 3.3.2-44

The staff reviewed LRA Table 3.3.2-44, which summarizes the results of AMR evaluations for the radwaste sampling system component groups.

In LRA Table 3.3.2-44, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage SCC and loss of material due to MIC for stainless steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effects of SCC and loss of material due to MIC for stainless steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.45 Auxiliary Systems - Summary of Aging Management Evaluation - Refueling System - LRA Table 3.3.2-45

The staff reviewed LRA Table 3.3.2-45, which summarizes the results of AMR evaluations for the refueling system component groups.

In LRA Table 3.3.2-45, the applicant proposed the Bolting Integrity Program to manage loss of material due to crevice and pitting corrosion and loss of preload due to thermal effects, gasket creep, and self-loosening for nickel-base alloy closure bolting exposed to treated water external environments and loss of preload due to thermal effects, gasket creep, and self-loosening for nickel based alloy closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, because the staff finds that, because these components will be inspected periodically, the aging effects of loss of material due to crevice and pitting corrosion and loss of preload due to thermal effects, gasket creep, and self-loosening for nickel-base alloy closure bolting exposed to treated water external environments and loss of preload due to thermal effects, gasket creep, and self-loosening for nickel-based alloy closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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).

3.3.2.3.46 Auxiliary Systems - Summary of Aging Management Evaluation - Spent Fuel Pool Cooling System - LRA Table 3.3.2-46

The staff reviewed LRA Table 3.3.2-46, which summarizes the results of AMR evaluations for the spent fuel pool cooling system component groups.

In LRA Table 3.3.2-46, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-46, the applicant proposed the Water Chemistry Program to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel fuel pool heat exchanger tubes exposed to treated water internal environments.

The staff's evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.1.1. The Water Chemistry Program description states that the program controls water chemistry for impurities (*e.g.*, oxygen, chlorides, fluorides, and sulfates) that accelerate corrosion. During the onsite audit, the staff asked the applicant to clarify how the Water Chemistry Program manages reduction of heat transfer effectiveness.

In its letter dated August 20, 2007, the applicant stated that the treated water on the inside of the tubes is spent fuel pool water maintained at a very high quality by the Water Chemistry Program with tube external surfaces managed by the Closed-Cycle Cooling Water System Program, which verifies heat transfer effectiveness. The staff confirmed management of the external surfaces of the fuel pool heat exchanger tubes by the Closed-Cycle Cooling Water System Program. The staff's evaluation of the Closed-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.7. On the basis of its review, the staff finds that the aging effect of reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel fuel pools heat exchanger tubes exposed to treated water internal environments will be effectively managed by the Water Chemistry Program with the Closed-Cycle Cooling Water System Program.

LRA Table 3.3.2-46 states that piping thermal insulation component types exposed to air-indoor environments exhibit no AERMs. During the audit and review, the staff confirmed that the materials in HNP thermal insulation include elastomeric closed cell foam, phenolic foam, calcium silicate, sodium silicate, mineral wool, glass wool, refractory fiber, rigid fibrous glass, insulation board, and fiberglass, that these insulation types similar to those elsewhere in the industry have exhibited no age-related degradation, and that plant-specific operating experience shows no aging effects for these materials. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that thermal insulation material exposed to air-indoor environments has any AERMs for its intended function.

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).

3.3.2.3.47 Auxiliary Systems - *Summary of Aging Management Evaluation - Spent Fuel Pool* Cleanup System - LRA Table 3.3.2-47

The staff reviewed LRA Table 3.3.2-47, which summarizes the results of AMR evaluations for the spent fuel pool cleanup system component groups.

In LRA Table 3.3.2-47, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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).

3.3.2.3.48 Auxiliary Systems - Summary of Aging Management Evaluation - Spent Fuel Cask Decontamination and Spray System - LRA Table 3.3.2-48

The staff reviewed LRA Table 3.3.2-48, which summarizes the results of AMR evaluations for the spent fuel cask decontamination and spray system component groups.

In LRA Table 3.3.2-48, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-48, the applicant proposed the One-Time Inspection Program to manage loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel piping, piping components, and piping elements and loss of material due to crevice and pitting corrosion for copper alloy greater than 15 percent zinc or stainless steel piping, piping components, and piping elements exposed to treated water internal environments.

The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.5. The One-Time Inspection Program description includes one-time inspections to verify the absence or slow progression of an aging effect. The staff noted that the applicant has included the fuel cask decontamination and spray system within the scope of the One-Time

Inspection Program to confirm that the aging effect of loss of material due to corrosion either is absent or progressing very slowly. In addition the staff confirmed that the system piping, piping components, and piping elements are no longer in service. On the basis of its review, because the staff finds that the aging effects of loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel piping, piping components, and piping elements and loss of material due to crevice and pitting corrosion for copper alloy greater than 15 percent zinc or stainless steel piping, piping components, and piping elements exposed to treated water internal environments will be effectively managed by the One-Time Inspection Program.

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).

3.3.2.3.49 Auxiliary Systems - Summary of Aging Management Evaluation - Spent Resin Storage and Transfer System - LRA Table 3.3.2-49

The staff reviewed LRA Table 3.3.2-49, which summarizes the results of AMR evaluations for the spent resin storage and transfer system component groups.

In LRA Table 3.3.2-49, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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).

3.3.2.3.50 Auxiliary Systems - Summary of Aging Management Evaluation - Containment Auxiliary Equipment - LRA Table 3.3.2-50

The staff reviewed LRA Table 3.3.2-50, which summarizes the results of AMR evaluations for the containment auxiliary equipment component groups.

LRA Table 3.3.2-50 states that stainless steel piping, piping components, and piping elements exposed to silicone internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species and silicone does not react with stainless steel; therefore, stainless steel piping, piping components, and piping elements exposed to silicone internal environments exhibit no aging effects, 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).

3.3.2.3.51 Auxiliary Systems - Summary of Aging Management Evaluation - Containment Liner Penetration Auxiliary Equipment - LRA Table 3.3.2-51

The staff reviewed LRA Table 3.3.2-51, which summarizes the results of AMR evaluations for the containment liner penetration auxiliary equipment component groups.

In LRA Table 3.3.2-51, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice, general, galvanic, and pitting corrosion for carbon or low-alloy steel piping, piping components, and piping elements; loss of material due to crevice, galvanic, and pitting corrosion for copper alloy greater than 15 percent zinc and aluminum or aluminum alloy piping, piping components, and piping elements; and loss of material due to crevice and pitting corrosion for stainless steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, becasue the staff finds that the aging effect of loss of material due to crevice, general, galvanic, and pitting corrosion for carbon or low-alloy steel piping, piping components, and piping elements; loss of material due to crevice, galvanic, and pitting corrosion for copper alloy greater than 15 percent zinc piping, piping components, and piping elements; and loss of material due to crevice and pitting corrosion for stainless steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.52 Auxiliary Systems - Summary of Aging Management Evaluation - Security Building HVAC System - LRA Table 3.3.2-52

The staff reviewed LRA Table 3.3.2-52, which summarizes the results of AMR evaluations for the security building HVAC system component groups.

In LRA Table 3.3.2-52, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens and fan housings exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens and fan housings exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

LRA Table 3.3.2-52 states that aluminum or aluminum alloy fan housings exposed to air/gas (wetted) environments exhibit no AERMs. Aluminum has an excellent resistance to corrosion when exposed to humid air (air-outdoor environment). The aluminum oxide film bonds strongly to its surface and, if damaged, reforms immediately in most environments. 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, the staff finds that aluminum or aluminum alloy fan housings exposed to air/gas (wetted) environments exhibit no aging effects, 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).

3.3.2.3.53 Auxiliary Systems - Summary of Aging Management Evaluation - Containment Vacuum Relief System - LRA Table 3.3.2-53

The staff reviewed LRA Table 3.3.2-53, which summarizes the results of AMR evaluations for the containment vacuum relief system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-53 are consistent with the GALL Report.

3.3.2.3.54 Auxiliary Systems - Summary of Aging Management Evaluation - Containment Pressurization System - LRA Table 3.3.2-54

The staff reviewed LRA Table 3.3.2-54, which summarizes the results of AMR evaluations for the containment pressurization system component groups.

In LRA Table 3.3.2-54, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel containment isolation piping and components exposed to air-indoor internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel containment isolation piping and components exposed to air-indoor internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.55 Auxiliary Systems - Summary of Aging Management Evaluation - Penetration Pressurization System - LRA Table 3.3.2-55

The staff reviewed LRA Table 3.3.2-55, which summarizes the results of AMR evaluations for the penetration pressurization system component groups.

In LRA Table 3.3.2-55, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

In LRA Table 3.3.2-55, the applicant proposed the One-Time Inspection Program to manage loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to air-indoor internal environments.

The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.5. The One-Time Inspection Program description includes one-time inspections to confirm absence or slow progression of an aging effect. The staff noted that the applicant has included the penetration pressurization system within the scope of the One-Time Inspection Program to confirm that the aging effect of loss of material due to corrosion either is absent or progresses very slowly. In addition the staff confirmed that normally the piping, piping components, and piping elements in this system are capped during operation so aging effects are unlikely. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice, general, and pitting corrosion for carbon or low-alloy steel piping, piping components, and piping elements exposed to air-indoor internal environments will be effectively managed by the One-Time Inspection Program.

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).

3.3.2.3.56 Auxiliary Systems - Summary of Aging Management Evaluation - Containment Cooling System - LRA Table 3.3.2-56

The staff reviewed LRA Table 3.3.2-56, which summarizes the results of AMR evaluations for the containment cooling system component groups.

LRA Table 3.3.2-56 states that copper alloy less than 15 percent zinc containment fan cooler cooling coils, containment fan cooler housings, and containment fan coil housings exposed to air/gas (wetted) external environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy less than 15 percent zinc component types exposed to air with borated water leakage, an environment more aggressive than the air/gas (wetted) environment in this line item. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, copper alloy less than 15 percent zinc containment fan cooler cooling coils, containment fan cooler housings, and containment fan coil housings exposed to air/gas (wetted) environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-56 states that stainless steel containment fan cooler housings and containment fan coil housings exposed to air/gas (wetted) environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, stainless steel containment fan cooler housings and containment fan coil housings exposed to air/gas (wetted) environments exhibit no aging effects, 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).

3.3.2.3.57 Auxiliary Systems - Summary of Aging Management Evaluation - Airborne Radioactivity Removal System - LRA Table 3.3.2-57

The staff reviewed LRA Table 3.3.2-57, which summarizes the results of AMR evaluations for the airborne radioactivity removal system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-57 are consistent with the GALL Report.

3.3.2.3.58 Auxiliary Systems - Summary of Aging Management Evaluation - Containment Atmosphere Purge Exhaust System - LRA Table 3.3.2-58

The staff reviewed LRA Table 3.3.2-58, which summarizes the results of AMR evaluations for the containment atmosphere purge exhaust system component groups.

In LRA Table 3.3.2-58, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the flow blockage due to dust buildup for galvanized steel ducting and components exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of flow blockage due to dust buildup for galvanized steel ducting and components exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.59 Auxiliary Systems - Summary of Aging Management Evaluation - Control Rod Drive Mechanism Ventilation System - LRA Table 3.3.2-59

The staff reviewed LRA Table 3.3.2-59, which summarizes the results of AMR evaluations for the control rod drive mechanism ventilation system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-59 are consistent with the GALL Report.

3.3.2.3.60 Auxiliary Systems - Summary of Aging Management Evaluation - Primary Shield and Reactor Supports Cooling System - LRA Table 3.3.2-60

The staff reviewed LRA Table 3.3.2-60, which summarizes the results of AMR evaluations for the primary shield and reactor supports cooling system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-60 are consistent with the GALL Report.

3.3.2.3.61 Auxiliary Systems - Summary of Aging Management Evaluation - Reactor Auxiliary Building Ventilation System - LRA Table 3.3.2-61

The staff reviewed LRA Table 3.3.2-61, which summarizes the results of AMR evaluations for the reactor auxiliary building ventilation system component groups.

In LRA Table 3.3.2-61, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice and pitting corrosion and MIC for stainless steel piping, piping components, and piping elements exposed to raw water internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion and MIC for stainless steel piping, piping components, and piping elements exposed to raw water internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-61, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens and fan housings exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens and fan housings exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-61, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the flow blockage due to dust buildup for galvanized steel ducting and components exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, the staff finds that the aging effect of flow blockage due to dust buildup for galvanized steel ducting and components exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-61 states that aluminum or aluminum alloy fan housings exposed to internal air/gas (wetted) environments exhibit no AERMs. Aluminum has an excellent resistance to corrosion when exposed to humid air (air-outdoor environment). The aluminum oxide film bonds strongly to its surface and, if damaged, reforms immediately in most environments. 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, the staff finds that aluminum or aluminum alloy fan housings exposed to internal air/gas (wetted) environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-61 states that copper alloy less than 15 percent zinc reactor auxiliary building safety-related cooling coils and cooling coil housings exposed to air/gas (wetted) environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy less than 15 percent zinc component types exposed to air with borated water leakage, an environment more aggressive than the air/gas (wetted) environment in this line item; therefore, copper alloy less than 15 percent zinc reactor auxiliary building safety-related cooling coils and cooling coil housings exposed to air/gas (wetted) environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-61 states that stainless steel reactor auxiliary building safety-related and nonsafety-related cooling coil housings exposed to air/gas (wetted) internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, stainless steel reactor auxiliary building safety-related and nonsafety-related cooling coil housings exposed to air/gas (wetted) internal environments exhibit no aging effects, 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).

3.3.2.3.62 Auxiliary Systems - Summary of Aging Management Evaluation - Emergency Service Water Intake Structure Ventilation System - LRA Table 3.3.2-62

The staff reviewed LRA Table 3.3.2-62, which summarizes the results of AMR evaluations for the emergency service water intake structure ventilation system component groups.

In LRA Table 3.3.2-62, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

LRA Table 3.3.2-62 states that stainless steel emergency service water intake structure cooling coil enclosures exposed to air/gas (wetted) internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, stainless steel emergency service water intake structure cooling coil enclosures exposed to air/gas (wetted) internal environments exhibit no aging effects, 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).

3.3.2.3.63 Auxiliary Systems - Summary of Aging Management Evaluation - Turbine Building Area Ventilation System - LRA Table 3.3.2-63

The staff reviewed LRA Table 3.3.2-63, which summarizes the results of AMR evaluations for the turbine building area ventilation system component groups.

In LRA Table 3.3.2-63, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-63, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage flow blockage due to dust buildup for galvanized steel ducting and components exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of flow blockage due to dust buildup for galvanized steel ducting and components exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

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).

3.3.2.3.64 Auxiliary Systems - Summary of Aging Management Evaluation - Waste Processing Building HVAC System - LRA Table 3.3.2-64

The staff reviewed LRA Table 3.3.2-64, which summarizes the results of AMR evaluations for the waste processing building HVAC system component groups.

In LRA Table 3.3.2-64, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.3.2-64, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage flow blockage due to dust buildup for galvanized steel ducting and components exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, becasue the staff finds that the aging effect of flow blockage due to dust buildup for galvanized steel ducting and components exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-64 states that copper alloy less than 15 percent zinc motor control center and instrument rack area cooling coil and cooling coil housing component types exposed to air/gas (wetted) environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy less than 15 percent zinc component types exposed to air with borated water leakage, an environment more aggressive than the air/gas (wetted) environment in this line item. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, copper alloy less than 15 percent zinc motor control center and instrument rack area cooling coil and cooling coil housing component types exposed to air/gas (wetted) environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-64 states that stainless steel motor control center and instrument rack area cooling coil housings exposed to air/gas (wetted) internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, stainless steel motor control center and instrument rack area cooling coil housings exposed to air/gas (wetted) internal environments exhibit no aging effects, 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).

3.3.2.3.65 Auxiliary Systems - Summary of Aging Management Evaluation - Diesel Generator Building Ventilation System - LRA Table 3.3.2-65

The staff reviewed LRA Table 3.3.2-65, which summarizes the results of AMR evaluations for the diesel generator building ventilation system component groups.

In LRA Table 3.3.2-65, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

LRA Table 3.3.2-65 states that stainless steel cooling coil housing component types exposed to air/gas (wetted) internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, stainless steel cooling coil housing component types exposed to air/gas (wetted) internal environments exhibit no aging effects, 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).

3.3.2.3.66 Auxiliary Systems - Summary of Aging Management Evaluation - Fuel Oil Transfer Pump House Ventilation System - LRA Table 3.3.2-66

The staff reviewed LRA Table 3.3.2-66, which summarizes the results of AMR evaluations for the fuel oil transfer pump house ventilation system component groups.

In LRA Table 3.3.2-66, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

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).

3.3.2.3.67 Auxiliary Systems - Summary of Aging Management Evaluation - Fuel Handling Building HVAC System - LRA Table 3.3.2-67

The staff reviewed LRA Table 3.3.2-67, which summarizes the results of AMR evaluations for the fuel handling building HVAC system component groups.

In LRA Table 3.3.2-67, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage flow blockage due to dust buildup for galvanized steel flow-restricting elements exposed to air/gas (wetted) internal environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of flow blockage due to dust buildup for galvanized steel flow-restricting elements exposed to air/gas (wetted) internal environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-67, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

LRA Table 3.3.2-67 states that copper alloy less than 15 percent zinc fuel handling building pump room cooling coil and cooling coil housing component types exposed to air/gas (wetted) environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy less than 15 percent zinc component types exposed to air with borated water leakage, an environment more aggressive than the air/gas (wetted) environment in this line item. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, copper alloy less than 15 percent zinc fuel handling building pump room cooling coil and cooling coil housing component types exposed to air/gas (wetted) external environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-67 states that stainless steel fuel handling building normal supply cooling coil housing and fuel handling building pump room cooling coil housing component types exposed to air/gas (wetted) internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, stainless steel fuel handling building normal supply cooling coil housing and fuel handling building pump room cooling coil housing component types exposed to air/gas (wetted) internal environments exhibit no aging effects, 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).

3.3.2.3.68 Auxiliary Systems - Summary of Aging Management Evaluation - Technical Support Center HVAC System - LRA Table 3.3.2-68

The staff reviewed LRA Table 3.3.2-68, which summarizes the results of AMR evaluations for the technical support center HVAC system component groups. The staff determined that all AMR evaluation results in LRA Table 3.3.2-68 are consistent with the GALL Report.

3.3.2.3.69 Auxiliary Systems - Summary of Aging Management Evaluation - Mechanical Components in Electrical Systems - LRA Table 3.3.2-69

The staff reviewed LRA Table 3.3.2-69, which summarizes the results of AMR evaluations for the mechanical components in electrical systems component groups.

LRA Table 3.3.2-69 states that copper alloy greater than 15 percent zinc or stainless steel piping, piping components, and piping elements and carbon or low-alloy steel tanks exposed to cable oil internal environments exhibit no AERMs. The staff accepts the position that copper, stainless steel, or steel when exposed to lubricating oil is not susceptible to aging degradation due to general or localized corrosion without water pooling. During the onsite audit, the staff confirmed that a vacuum pump removes moisture from the cable; therefore, copper alloy greater than 15 percent zinc or stainless steel piping, piping components, and piping elements and carbon or low-alloy steel tanks exposed to cable oil internal environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-69 states that copper alloy greater than 15 percent zinc or stainless steel piping, piping components, and piping elements exposed to air-outdoor environments exhibit no AERMs. During the onsite audit, the staff confirmed that HNP is not located near the sea nor in an industrial location. The staff finds this LRA statement acceptable because without an aggressive outdoor air environment these component types are not subject to aging degradation; therefore, copper alloy greater than 15 percent zinc or stainless steel piping, piping components, and piping elements and carbon or low-alloy steel tanks exposed to air-outdoor environments exhibit no AERMs, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

In LRA Table 3.3.2-69, the applicant proposed the Bolting Integrity Program to manage loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments.

The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3.2.5. The Bolting Integrity Program description includes bolting and closure inspections. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," with an exception to the ASME Code version cited in the GALL Report. On the basis of its review, the staff finds that, because these components will be inspected periodically, the aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening for stainless steel closure bolting exposed to air-indoor environments will be effectively managed by the Bolting Integrity Program.

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).

3.3.2.3.70 Auxiliary Systems - Summary of Aging Management Evaluation - Post-Accident Hydrogen System - LRA Table 3.3.2-70

The staff reviewed LRA Table 3.3.2-70, which summarizes the results of AMR evaluations for the post-accident hydrogen system component groups.

In LRA Table 3.3.2-70, the applicant proposed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to crevice and pitting corrosion for stainless steel hydrogen analyzer tubing and valves, remote sample dilution panel refrigeration units, and remote sample dilution panel tubing and valves exposed to raw water internal environments; remote sample dilution panel refrigeration units and remote sample dilution panel sample coolers exposed to treated water internal environments; and remote sample dilution panel sample cooler tubes exposed to treated water environments.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program description includes periodic visual inspections of internal surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for stainless steel hydrogen analyzer tubing and valves, remote sample dilution panel refrigeration units, and remote sample dilution panel tubing and valves exposed to raw water internal environments; remote sample dilution panel refrigeration units and remote sample dilution panel sample coolers exposed to treated water internal environments; and remote sample dilution panel sample cooler tubes exposed to treated water environments will be effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.3.2-70 states that piping thermal insulation component types exposed to air-indoor environments exhibit no AERMs. During the audit and review, the staff confirmed that the materials in HNP thermal insulation include elastomeric closed cell foam, phenolic foam, calcium silicate, sodium silicate, mineral wool, glass wool, refractory fiber, rigid fibrous glass, insulation board, and fiberglass, that these insulation types similar to those elsewhere in the industry have exhibited no age-related degradation, and that plant-specific operating experience shows no aging effects for these materials. The staff finds this LRA statement acceptable because there is no indication in industry operating experience that thermal insulation material exposed to air-indoor environments has any AERMs for its intended function.

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).

3.3.2.3.71 Auxiliary Systems - Summary of Aging Management Evaluation - Control Room Area Ventilation System - LRA Table 3.3.2-71

The staff reviewed LRA Table 3.3.2-71, which summarizes the results of AMR evaluations for the control room area ventilation system component groups.

In LRA Table 3.3.2-71, the applicant proposed the External Surfaces Monitoring Program to manage loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. The External Surfaces Monitoring Program description includes periodic visual inspections of external surfaces of piping, piping elements, ducting, and components for timely detection of component degradation. The program directs thorough and consistent inspections of SSCs with inspection criteria that focus on detection of aging effects. On the basis of its review, because the staff finds that the aging effect of loss of material due to crevice and pitting corrosion for aluminum or aluminum alloy bird screens exposed to air-outdoor environments will be effectively managed by the External Surfaces Monitoring Program.

LRA Table 3.3.2-71 states that copper alloy less than 15 percent zinc control room air-handling units and emergency filtration unit enclosures and control room air-handling unit cooling coils exposed to air/gas (wetted) environments exhibit no AERMs. The staff finds this statement acceptable because the GALL Report indicates no AERMs for copper alloy less than 15 percent zinc component types exposed to air with borated water leakage, an environment more aggressive than the air/gas (wetted) environment in this line item. In addition, during the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, copper alloy less than 15 percent zinc control room air-handling units and emergency filtration unit enclosures and control room air-handling unit cooling coils exposed to air/gas (wetted) environments exhibit no aging effects, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

LRA Table 3.3.2-71 states that stainless steel control room air-handling units and emergency filtration unit enclosures exposed to air/gas (wetted) internal environments exhibit no AERMs. The staff finds this statement acceptable because stainless steel is highly resistant to corrosion in the absence of corrosive species. During the onsite audit, the staff confirmed that because the component design drains away any condensate there is no mechanism for contaminant concentration; therefore, stainless steel control room air-handling units and emergency filtration unit enclosures exposed to air/gas (wetted) internal environments exhibit no aging effects, 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).

3.3.3 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:

- steam generator blowdown system
- steam generator chemical addition system
- main steam supply system
- steam dump system
- auxiliary boiler/steam system
- feedwater system
- feedwater heater drains & vents system
- auxiliary feedwater system
- auxiliary steam condensate system
- condensate system
- condensate storage system
- secondary sampling system
- steam generator wet lay up system
- turbine system
- digital-electric hydraulic system
- turbine-generator lube oil 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 Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion Systems," 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 operating experience 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 operating experience included a review of the GALL Report and operating experience 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 3.2.2.2.1)
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 to HNP (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 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 HNP (See SER Section 3.4.2.1.1)
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	Water Chemistry Program (B.2.2) and One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.2)
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 to PWRs (See SER Section 3.2.2.1.1)
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	Water Chemistry Program (B.2.2) and One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.7)
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	Lubricating Oil Analysis Program (B.2.25) and One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.2)
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 to HNP (See SER Section 3.4.2.1.1)
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	Water Chemistry Program (B.2.2) and One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.4)

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, 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	Lubricating Oil Analysis Program (B.2.25) and One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.4)
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 to HNP (See SER Section 3.4.2.2.5)
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 to HNP (See SER Section 3.4.2.2.5)
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	Not applicable	Not applicable to PWRs (See SER Section 3.4.2.1.1)
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	Water Chemistry Program (B.2.2) and One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (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	Water Chemistry Program (B.2.2) and One-Time Inspection Program (B.2.18)	Not applicable to HNP (See SER Section 3.4.2.2.7)

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; 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	Water Chemistry Program (B.2.2) and One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.7)
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	Not applicable	Not applicable to HNP (See SER Section 3.4.2.1.1)
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 to HNP (See SER Section 3.4.2.1.1)
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	Lubricating Oil Analysis Program (B.2.25) and One-Time Inspection Program (B.2.18)	Consistent with GALL Report, which recommends further evaluation (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	Not applicable	Not applicable to HNP (See SER Section 3.4.2.1.1)
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	Not applicable	Not applicable to HNP (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 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.2.8)	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	Closed-Cycle Cooling Water System Program (B.2.11)	Not applicable to steam and power conversion systems (See SER Section 3.4.2.1.1)
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 HNP (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	Closed-Cycle Cooling Water System Program (B.2.11)	Not applicable to steam and power conversion systems (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 HNP (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	Closed-Cycle Cooling Water System Program (B.2.11)	Not applicable to steam and power conversion systems (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 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	External Surfaces Monitoring Program (B.2.22)	Consistent with GALL Report
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 Program (B.2.7)	Consistent with GALL Report
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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.24)	Consistent with GALL Report
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 to HNP (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 HNP (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 HNP (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, 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 HNP (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	Not applicable	Not applicable to HNP (See SER Section 3.4.2.1.1)
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	Selective Leaching of Materials Program (B.2.19)	Consistent with GALL Report
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	Water Chemistry Program (B.2.2)	Consistent with GALL Report
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	Boric Acid Corrosion Program (B.2.4)	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to steam (3.4.1-39)	Cracking due to stress corrosion cracking	Water Chemistry	No	Water Chemistry Program (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
Glass piping elements exposed to air, lubricating oil, raw water, and treated water (3.4.1-40)	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) (3.4.1-41)	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	None	Consistent with GALL Report
Steel and stainless steel piping, piping components, and piping elements in concrete (3.4.1-43)	None	None	No	None	Consistent with GALL Report
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 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:

- Water Chemistry Program
- Boric Acid Corrosion Program
- Flow-Accelerated Corrosion Program
- Bolting Integrity Program
- Closed-Cycle Cooling Water System Program
- One-Time Inspection Program
- Selective Leaching of Materials Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces In Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program

LRA Tables 3.4.2-1 through 3.4.2-13 summarize 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's evaluation follows.

3.4.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.4.1, items 3.4.1-02, -03, -05, -08, -11, -12, -13, -15, -17, -18, -20, -21, -23, -24, -25, -26, -27, -31, -32, -33, -34, and -35 are identified as "Not Applicable" since the component, material, and environment combination for steam and power conversion systems does not exist at HNP or they are applicable to BWR plants only. For each of these 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 for steam and power conversion systems does not exist at HNP. On the basis that HNP steam and power conversion systems do not have the component, material, and environment combination for these Table 1 items, the staff concurs with the applicant's conclusion that these items are not subject to an AMR for steam and power conversion systems.

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, microbiologically-influenced corrosion, and fouling
- reduction of heat transfer due to fouling
- loss of material due to general, pitting, and 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, and its subsections, against the following criteria in SRP-LR Section 3.4.2.2.2:

(1) LRA Section 3.4.2.2.2.1 addresses loss of material due to general, pitting, and crevice corrosion in steel piping and components exposed to treated water and steam, stating that loss of material due to general, pitting, and crevice corrosion could occur on steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and on steel piping, piping components, and piping elements exposed to steam. A combination of the Water Chemistry Program and the One-Time Inspection Program manages piping components exposed to treated water. The Water

Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate cracking and loss of material aging effects. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.2.1 is SRP-LR Section 3.4.2.2.2, Item (1). SRP-LR Section 3.4.2.2.2, Item (1), 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.

SRP-LR Section 3.4.2.2.2, Item (1) invokes by reference AMR Items 2, 3, and 4 in GALL Report, Volume 1, Table 4. AMR Items 3.4.1-02, -03, and -04 in LRA Table 3.4.1 provide the AMRs that correspond to these GALL AMRs. The discussions in LRA AMR Items 3.4.1-02, -03, and -04 indicated that the applicant determined that AMR Item 4 in GALL Report, Volume 1, Table 4, was the applicable GALL AMR item that pertained to HNP for this AMR assessment and that the assessment pertains to the management of loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements in the main steam, feedwater, condensate, steam generator blowdown, and auxiliary feedwater systems. The applicant stated that HNP manages loss of material due to general, pitting, and crevice corrosion in these components with the Water Chemistry Program and the One-Time Inspection Program. The staff noted that this is consistent with the criteria and AMPs recommended for aging management in SRP-LR Section 3.4.2.2.2, Item (1) and in AMR Item 4 in GALL Report, Volume 1, Table 4.

The applicant has aligned a number of the AMR items in the LRA's Type 2 Tables for steel steam generator system components (*i.e.*, LRA Table 3.1.2-6) and for steel auxiliary system components (*i.e.*, the LRA Tables designated as 3.3.2-X) to LRA AMR Item 3.4.1-04 and has credited the One-Time Inspection Program and the Water Chemistry Program to manage loss of material due to general, pitting, and crevice corrosion in these components.

The staff's review of LRA Section 3.4.2.2.2 identified areas in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.4-9 dated January 7, 2008, the staff asked the applicant to provide its basis for aligning the Type 2 AMR items for these steel steam generator system components, as given in LRA Table 3.1.2-6, and the Type 2 AMR items for these steel auxiliary system components, as given in LRA Tables 3.3.2-X, to LRA AMR Item 3.4.1-04, which is a steam and power conversion system AMR item. The staff also asked the applicant to justify why it is acceptable to credit the One-Time Inspection Program and the Water Chemistry Program to manage loss of material due to general, pitting, and crevice corrosion in these steel steam generator system and steel auxiliary system components in lieu of crediting an AMP that implements periodic inspections of the components.

In its response dated January 17, 2008, the applicant clarified that the steam generator items and auxiliary system components that the applicant's methodology had aligned to AMR Item 4 in GALL Report, Volume 1, Table 4, were components that were in the steam generator system or auxiliary systems that are exposed to the feedwater environment. Specifically, the applicant clarified that this pertained to the AMR item for the steel steam generator manifolds in LRA Table 3.1.2-6 and the AMRs for steel piping, piping components, and piping elements in some of the Type "2" tables for the auxiliary systems (*i.e.,* the 3.3.2-X tables in the LRA). The applicant justified that the crediting of the Water Chemistry Program and the One-Time Inspection Program for the surfaces that are exposed to a treated-water (*i.e.,* treated feedwater) environment was consistent with the staff's recommendations in AMR item 4 in GALL Report, Volume 1, Table 4, and in GALL AMR VIII.D1-8.

Based on this response, the staff concludes that it is valid to align the applicant's AMRs for these steel components to AMR item 4 in GALL Report, Volume 1, Table 4, and to GALL AMR VIII.D1-8, because the component surfaces addressed in the applicant's AMR are exposed to a treated feedwater environment.

The staff reviewed the Water Chemistry Program, which monitors chlorides, fluorides, and dissolved oxygen to limit the contaminants, thus minimizing the occurrences of aging effects, and maintaining component ability to perform intended functions. The staff verified that the applicant is crediting its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program and to confirm that loss of material due to general, pitting, or crevice corrosion is not an applicable aging effect for the piping, piping components, and piping elements in the main steam, feedwater, condensate, steam generator blowdown, and auxiliary feedwater systems. The staff also verified that the One-Time Inspection Program includes criteria and program elements for inspection of select steel components in the main steam, feedwater, condensate, steam generator blowdown, and auxiliary feedwater systems to monitor for loss of material due to general, pitting, and crevice corrosion.

Based on these verifications and the applicant's response to RAI 3.4-9, the staff concludes that it is valid to credit the Water Chemistry Program and the One-Time Inspection Program to manage loss of material due to general, pitting, and crevice corrosion in the component surfaces that are exposed to the treated feedwater environment because this is in conformance with the staff's recommendations in SRP-LR Section 3.4.2.2.2, Item (1), AMR Item 4 in GALL Report, Volume 1, Table 4, and in GALL AMR VIII.D1-8. Based on this review, the staff concludes the crediting of the Water Chemistry Program and the One-Time Inspection Program is adequate to manage loss of material due to general, pitting, and crevice corrosion on internal surfaces of these steel components. The staff evaluated the

Water Chemistry Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively.

Based on its review, the staff finds the applicant's response to RAI 3.4-9 acceptable. The staff's concern described in RAI 3.4-9 is resolved.

The applicant identified that AMR Item 2 in GALL Report, Volume 1, Table 4, which pertains to loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements in the steam turbine and extraction steam systems, is not applicable to HNP because the corresponding piping, piping components, and piping elements in the steam turbine system are made from stainless steel and because the extraction steam system is not within the scope of license renewal. The staff concludes that the applicant has provided a valid basis to exclude these steam turbine system components from the scope of this AMR because the components are made from stainless steel and because the stainless steel materials are resistant to general, pitting, and crevice corrosion in steam environments.

The staff questioned the applicant's determination on whether the steel piping components in the extraction steam system are applicable to AMR Item 2 of GALL Report, Volume 2, Table 4. GALL Report, Volume 2, Table VIII.C, identifies that the extraction steam systems is a steam and power conversion system that may be within the scope of license renewal and recommends that the components in this system be subject to an AMR.

In RAI 3.4-10, Part A, dated January 7, 2008, the staff asked the applicant to justify why the extraction steam system was not within the scope of license renewal and why the extraction steam piping, piping components, and piping elements made from steel materials (*i.e.*, carbon steel, low-alloy steel, or cast iron materials) would not be subject to the loss of material effect discussed in AMR Item 2 of GALL Report, Volume 1, Table 4.

In its response dated January 17, 2008, the applicant clarified that, according to LRA Table 2.2-1, "License Renewal Scoping Results for Mechanical Systems," the extraction steam system did not meet any of the scoping criteria of either 10 CFR 54.4(a)(1), (a)(2), or (a)(3). The applicant clarified that based on this scoping determination, the applicable AMR line item in the GALL Report for the extraction steam system does not apply to the LRA.

Based on its review, the staff finds the applicant's response to RAI 3.4-10, Part A, acceptable. In SER Section 2.3 of the staff's evaluation of the applicant's scoping results for this LRA, the staff supports its basis that the extraction steam system is not within the scope of the LRA. Based on this assessment, the staff finds that the applicant has a valid basis for not including any AMR line item aligning to AMR 2 of GALL Report, Volume 1, Table 4, and to GALL AMR VIII.C-4, because the extraction steam system does not meet the criteria for a system that is within the scope of license renewal in accordance with either 10 CFR 54.4(a)(1), (a)(2), or (a)(3). The staff's concern described in RAI 3.4-10, Part A, is resolved.

In RAI 3.4-10, Part B, dated January 7, 2008, the staff asked the applicant to clarify whether condensate or steam generator blowdown systems included any steel heat exchangers that are brought into the scope of license renewal under the specific scoping criteria of 10 CFR 54.4(a)(2), and if so, to provide a basis why these heat exchangers would not be within the scope of AMR Item 3 in GALL Report, Volume 1.

In its response dated January 17, 2008, the applicant clarified that AMR Item 3 in GALL Report, Volume 1, Table 4, is not applicable to HNP because the portions of these systems that are within the scope of license renewal do not include heat exchanger components.

AMR Item 3 of GALL Report, Volume 1, Table 4, provides the staff's recommendations for managing loss of material due to general pitting, and crevice corrosion in steel heat exchanger components of the condensate system and the steam generator blowdown system that are exposed to treated water. This GALL AMR invokes, in part GALL AMR Item VIII.E-37 for the corresponding AMR for steel heat exchangers in PWR-designed condensate systems and GALL AMR Item VIII.F-28 for the corresponding AMR for heat exchangers in the steam generator blowdown system. In each of these AMRs, the staff recommends that the Water Chemistry Program be used to manage loss of material due to general, pitting, and crevice corrosion in the steel heat exchanger surfaces that are exposed to treated water and to credit the One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in mitigating or preventing loss of material due to these aging mechanisms. The applicant has clarified that the portions of the condensate system and the steam generator system that have been brought into the scope of license renewal do not include and steel heat exchanger components.

Based on this analysis, the staff finds the applicant's response to RAI 3.4-10, Part B, acceptable because the applicant has provided a valid basis for concluding that the LRA does not need to include any AMRs that align to AMR Item 3 of GALL Report, Volume 1, Table 4, and to GALL AMR Items VIII.E-37 and VIII.F-28. The staff's concern described in RA 3.4-10, Part B, is resolved.

(2) LRA Section 3.4.2.2.2.2 addresses loss of material due to general, pitting, and crevice corrosion in steel piping components exposed to lubricating oil, stating that a combination of the Lubricating Oil Analysis Program and the One-Time Inspection Program manages piping components exposed to lubricating oil. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.2.2 is SRP-LR Section 3.4.2.2.2, Item (2). SRP-LR Section 3.4.2.2.2, Item (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.

SRP-LR Section 3.4.2.2.2, Item (2), invokes by reference AMR Item 7 in GALL Report, Volume 1, Table 4, which pertains to piping, piping components, and piping element surfaces in the steam turbine, feedwater, condensate, and auxiliary feedwater systems that are exposed to a lubricating oil environment. AMR Item 3.4.1-07 in LRA Table 3.4.1 provides the corresponding AMR to the GALL AMR. In the discussion column of AMR 3.4.1-07, the applicant stated that HNP manages loss of material due to general, pitting, and crevice corrosion with the Lubricating Oil Analysis and One-Time Inspection Programs consistent with the GALL Report.

The staff reviewed the Lubricating Oil Analysis Program, which maintains oil system contaminants, primarily water and particulate, within acceptable limits, thereby preserving an environment that is not conducive to loss of material due to general, pitting, and crevice corrosion, thus minimizing the occurrences of aging effects and maintaining component ability to perform intended functions. The staff verified that the applicant is crediting its One-Time Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program and to confirm that loss of material due to general, pitting, or crevice corrosion is not an applicable aging effect for the piping, piping components, and piping elements in the steam turbine, feedwater, condensate, and auxiliary feedwater systems that are exposed to a lubricating oil environment. The staff also verified that the One-Time Inspection Program provides criteria and program elements for the inspection of select steel components in the piping, piping components, and piping elements in the steam turbine, feedwater, condensate, and auxiliary feedwater systems to monitor for loss of material due to general, pitting, and crevice corrosion in the surfaces that are exposed to lubricating oil.

The staff finds that the crediting of the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage loss of material due to general, pitting, and crevice corrosion in these steel components is consistent with recommendations in SRP-LR Section 3.4.2.2.2, Item (1), and in AMR Items 4 and 6 in GALL Report, Volume 1, Table 4, and is acceptable. Based on this review, the staff concludes the applicant's crediting of the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to general, pitting, and crevice corrosion on internal surfaces of these steel components under exposure to lubricating oil. The staff evaluated the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

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, and crevice, and microbiologically-influenced corrosion, and fouling, stating that this aging effect is not applicable because the portions of the auxiliary feedwater system within the scope of license renewal are not exposed to raw water.

The section in the SRP-LR that corresponds to the LRA Section 3.4.2.2.3 is SRP-LR Section 3.4.2.2.3. 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.

SRP-LR Section 3.4.2.2.3 invokes by reference AMR Item 8 in GALL Report, Volume 1, Table 4, which pertains to the management of loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements under exposure to raw water. AMR Item 3.4.1-08 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 8 in GALL Report, Volume 1, Table 4, is applicable to the LRA.

In LRA Section 3.4.2.2.3 and in LRA AMR Item 3.4.1-08, the applicant stated that the assessments in SRP-LR Section 3.4.2.2.3 and in the GALL AMR are not applicable to the LRA because the portions of the auxiliary feedwater system within the scope of license renewal do not include any surfaces that are exposed to raw water. The staff has confirmed that the AMRs for the component commodity groups in Type 2 AMR Table for the auxiliary feedwater system (*i.e.*, in LRA Table 3.4.2-7) do not include any AMRs on exposure of the commodity group components to raw water. Based on this review, the staff finds that is valid to conclude that the evaluations in SRP-LR Section 3.4.2.2.3 and AMR Item 8 in GALL Report, Volume 1, Table 4, are not applicable to HNP and that the LRA does not need to include a corresponding AMR Item.

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.4.2.2.4, and its subsections, against the following criteria in SRP-LR Section 3.4.2.2.4:

(1) LRA Section 3.4.2.2.4.1 addresses reduction of heat transfer due to fouling in heat exchanger tubes exposed to treated water, stating that reduction of heat transfer due to fouling could occur for stainless steel and cooper heat exchanger tubes exposed to treated water. A combination of the Water Chemistry Program and One-Time Inspection

Program manages heat exchanger components exposed to treated water. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate cracking and loss of material aging effects. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

The section in the SRP LR that corresponds to LRA Section 3.4.2.2.4.1 is SRP-LR Section 3.4.2.2.4, Item (1). SRP-LR Section 3.4.2.2.4, Item (1), 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.

SRP-LR Section 3.4.2.2.4, Item (1), invokes by reference AMR Item 9 in GALL Report, Volume 1, Table 4, which pertains to the management of reduction of heat transfer due to fouling in stainless steel or copper exchanger tubes in the condensate, steam generator blowdown, and auxiliary feedwater systems. AMR Item 3.4.1-09 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 9 in GALL Report, Volume 1, Table 4, is applicable to HNP. In the discussion column of AMR Item 3.4.1-09, the applicant stated that analysis in AMR Item 3.4.1-09 is consistent the position in AMR Item 9 of GALL Report, Volume 1, Table 4, and that HNP manages with the reduction of heat transfer due to fouling in these heat exchanger tubes exposed to treated water with the Water Chemistry Program and the One-Time Inspection Program.

The staff reviewed the Water Chemistry Program, which monitors chlorides, fluorides, and dissolved oxygen to limit the contaminants, thus minimizing the occurrences of aging effects, and maintaining component ability to perform intended functions. The staff verified that the applicant is crediting its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program and to confirm that reduction of heat transfer due to fouling is not an applicable aging effect for these heat exchangers. The staff also verified that the One-Time Inspection Program includes appropriate criteria and program elements for the inspection of select stainless components exposed to treated water at susceptible locations for reduction of heat transfer due to fouling in steam and power conversion systems.

The staff finds that the crediting of the Water Chemistry Program and the One-Time Inspection Program to manage reduction of heat transfer due to fouling in these steel components is consistent with recommendations in SRP-LR Section 3.4.2.2.4, Item (1), and in AMR Item 9 in GALL Report, Volume 1, Table 4, and is acceptable. Based on this review, the staff concludes that the applicant's crediting of the Water Chemistry Program and the One-Time Inspection Program is adequate to manage reduction of heat transfer due to fouling in the stainless steel heat exchanger tubes of the condensate, steam generator blowdown, and auxiliary feedwater systems that are exposed to treated water. The staff evaluated the Water Chemistry Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively.

(2) LRA Section 3.4.2.2.4.2 addresses reduction of heat transfer due to fouling in heat exchanger tubes exposed to lubricating oil, stating that reduction of heat transfer due to fouling could occur for heat exchanger tubes exposed to lubricating oil. A combination of the Lubricating Oil Analysis Program and the One-Time Inspection Program manages Steam and Power Conversion System heat exchanger components exposed to lubricating oil. The Lubricating Oil Analysis Program maintains oil system contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.4.2 is SRP-LR Section 3.4.2.2.4, Item (2). SRP-LR Section 3.4.2.2.4, Item (2), 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.

SRP LR Section 3.4.2.2.4, Item (2), invokes by reference AMR Item 10 in GALL Report, Volume 1, Table 4, which pertains to the management of reduction of heat transfer due to fouling of steel, stainless steel and copper heat exchanger tubes in the auxiliary feedwater system under exposure to lubricating oil. AMR Item 3.4.1-10 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 10 in the GALL Report, Volume 1, Table 4, is applicable to the LRA. The AMRs in LRA Table 3.4.2-7 identify that the applicable heat exchanger components are those for the auxiliary feedwater pump turbine lube oil cooler components and that these components are fabricated from stainless steel. In the discussion column of AMR Item 3.4.1-10, the applicant identified that AMR Item 3.4.1-10 is consistent with AMR Item 10 in GALL Report, Volume 1, Table 4, and that HNP manages the reduction of heat transfer due to fouling in auxiliary feedwater system heat exchanger tubes that are exposed to lubricating oil with the Lubricating Oil Analysis Program and the One-Time Inspection Program. The applicant stated that this is consistent with the GALL Report.

The staff reviewed the Lubricating Oil Analysis Program, which maintains oil system contaminants, primarily water and particulate, within acceptable limits, thereby preserving an environment that is not conducive to reduction of heat transfer due to fouling, thus minimizing the occurrences of aging effects and maintaining component ability to perform intended functions. The staff verified that the applicant is crediting its One-Time Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program and to confirm that fouling has not occurred in these auxiliary feedwater heat exchanger components. The staff also verified that the One-Time Inspection Program includes applicable criteria and program elements for the inspection of these heat exchanger components to monitor for fouling.

The staff finds that the crediting of the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage reduction of heat transfer due to fouling in these stainless steel heat exchanger components is consistent with recommendations in SRP-LR Section 3.4.2.2.4, Item (2), and in AMR Item 10 of the GALL Report, Volume 1, Table 4, and is acceptable. Based on this review, the staff concludes that the applicant's crediting of the Lubricating Oil Analysis Program and the One-Time Inspection Program is adequate to manage reduction of heat transfer due to fouling in the stainless steel auxiliary feedwater system heat exchanger tubes that are exposed to lubricating oil. The staff evaluated the Water Chemistry Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.4 criteria. For those line items that apply to LRA Section 3.4.2.2.4, 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).

3.4.2.2.5 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 SRP-LR Section 3.4.2.2.5 criteria:

(1) LRA Section 3.4.2.2.5.1 addresses loss of material due to general, pitting, and crevice corrosion, and MIC in steel piping components and tanks exposed to soil, stating that this aging effect is not applicable because the auxiliary feedwater system and condensate system have no steel components exposed to soil.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.5.1 is SRP-LR Section 3.4.2.2.5, Item (1). SRP-LR Section 3.4.2.2.5, Item (1), 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 in the condensate and auxiliary feedwater systems that are exposed to a soil environment.

SRP-LR Section 3.4.2.2.5, Item (1), invokes by reference AMR Item 11 in GALL Report, Volume 1, Table 4, which pertains to the management of loss of material due to general, pitting, or crevice corrosion in buried steel piping, piping components, piping elements, or tanks (with or without associated coatings or wrappings) of the condensate and auxiliary feedwater systems under exposure to soil environments. AMR Item 3.4.1-11 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 11 in GALL Report, Volume 1, Table 4, is applicable to the LRA. In the discussion column of AMR Item 3.4.1-11, the applicant clarified that this AMR is not applicable to HNP because the condensate and auxiliary feedwater systems do not include any components within the scope of license renewal that are exposed to a soil environment.

The staff verified that the Type 2 AMR tables for the condensate and auxiliary feedwater systems do not include any AMRs on steel components that are exposed to a soil environment. Therefore, the staff finds that the AMR analysis in SRP-LR Section 3.4.2.2.5, Item (1), and in AMR Item 11 of the GALL Report, Volume 1, Table 4, do not apply to HNP steam and power conversion systems because the auxiliary feedwater and condensate systems do not include any piping, piping components, piping elements, or tanks that are within the scope of license renewal and are exposed to a soil environment.

(2) LRA Section 3.4.2.2.5.2 addresses loss of material due to general, pitting, and crevice corrosion, and MIC in steel heat exchanger components exposed to lubricating oil, stating that this aging effect is not applicable because the auxiliary feedwater system heat exchanger components are fabricated from stainless steel.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.5.2 is SRP-LR Section 3.4.2.2.5, Item (2). SRP-LR Section 3.4.2.2.5, Item (2), states that loss of material due to general, pitting, and crevice corrosion, and MIC may occur in steel heat exchanger components in the auxiliary feedwater system that are exposed to lubricating oil.

SRP-LR Section 3.4.2.2.5, Item (2), invokes by reference AMR Item 12 in GALL Report, Volume 1, Table 4. AMR Item 3.4.1-12 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 12 in GALL Report, Volume 1,Table 4, is applicable to the LRA. In the discussion column of AMR Item 3.4.1-12, the applicant clarified that this AMR is not applicable to HNP because the auxiliary feedwater system heat exchanger components are fabricated from stainless steel and not from steel materials (*i.e.,* carbon steel or low alloy steel).

The staff verified that the Type 2 AMR table for the auxiliary feedwater system does not include any AMRs on steel components that are exposed to a soil environment. Therefore, the staff concludes that the AMR analyses in SRP-LR Section 3.2.2.2.5.2 and in AMR Item 12 of GALL Report, Volume 1, Table 4, do not apply to HNP steam and power conversion systems because the auxiliary feedwater system does not have any steel heat exchanger components that are exposed to a lubricating oil environment.

The staff has verified that LRA Table 3.4.2-7 does include an AMR on loss of material due to pitting and crevice corrosion in the stainless steel auxiliary feedwater pump turbine lube oil cooler components that are exposed to a lubricating oil or hydraulic fluid environment and that the applicant has aligned this AMR item to AMR Item 3.4.1-19 in the LRA. The staff verified that the applicant credits the Lubricating Oil Analysis Program and One-Time Inspection Program to manage this aging effect. The staff finds that the AMPs credited to manage loss of material due to pitting and crevice corrosion in these heat exchanger components are consistent with the AMPs recommended for aging management in AMR Item VIII.G-3 of the GALL Report, Volume 2, and are acceptable. The staff evaluation of this AMR is given in SER Section 3.1.2.1.

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 SCC, stating that such cracking could occur in stainless steel piping, piping components, and piping elements, tanks, and heat exchanger components exposed to steam or treated water greater than 140 °F. A combination of the Water Chemistry Program and the One-Time Inspection Program manages stainless steel piping components exposed to treated water. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate cracking and loss of material aging effects. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.6 is SRP-LR Section 3.4.2.2.6. 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.

For PWR designs, SRP-LR Section 3.4.2.2.6 invokes by reference AMR Item 14 in GALL Report, Volume 1, Table 4. AMR Item 3.4.1-14 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 14 in GALL Report, Volume 1, Table 4, is applicable to the LRA. In the discussion column of AMR Item 3.4.1-14, the applicant stated that HNP manages cracking due to SCC of stainless steel piping, piping components, piping elements, tanks, and heat exchanger components in its steam and power conversion systems with the Water Chemistry Program and the One-Time Inspection Program consistent with the GALL Report.

The staff reviewed the Water Chemistry Program, which monitors chlorides, fluorides, and dissolved oxygen to limit the contaminants thus minimizing the occurrences of aging effects and maintaining component ability to perform intended functions. The staff also verified that the applicant is crediting its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program and to confirm that cracking has not occurred in these piping, tank, and heat exchangers components. The staff also verified that the applicant's One-Time Inspection Program includes applicable criteria and program elements for the inspection of these piping, tank, and heat exchanger components and to monitor for cracking. The staff finds that these programs include activities that are consistent with recommendations in the GALL Report, and are adequate to manage cracking due to SCC of stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60 °C (greater than 140 °F) in the steam and power conversion systems. The staff evaluated the Water Chemistry Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.1.1 and 3.0.3.1.5, respectively.

The applicant has aligned a number of the AMR items on cracking due to SCC of stainless steel auxiliary system components, as provided in the Type 2 LRA Tables designated as 3.3.2-X (X being an integer defined in the LRA) to LRA AMR Item 3.4.1-14 and has credited the One-Time Inspection Program and the Water Chemistry Program to manage cracking due to SCC in these components.

The staff's review of LRA Section 3.4.2.2.6 identified an area in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.4-11 dated January 7, 2008, the staff asked the applicant to provide its basis for aligning the Type 2 AMR items for these stainless steel auxiliary system components to LRA AMR Item 3.4.1-14, which is a steam and power conversion system AMR item, and to justify why it is acceptable to credit the One-Time Inspection Program and the Water Chemistry Program to manage cracking due to SCC in these stainless steel auxiliary system components in lieu of crediting an AMP that implements periodic inspections of the components.

In its response dated January 17, 2008, the applicant clarified that AMR Item 3.4.1-14 in LRA Table 3.4.1 was a rolled up AMR for managing cracking due to SCC in stainless steel piping, piping components, and piping elements that are exposed to a treated water environment, and that, consistent with the recommendations in AMR Item 14 of GALL Report, Volume 1, Table 4, the Water Chemistry Program is credited to manage cracking due to SCC in the component surfaces that are exposed to the treated water environment, and the One-Time Inspection Program is credited to verify the effectiveness of the Water Chemistry Program to manage this aging effect. The applicant clarified that the auxiliary system AMR that aligned to AMR Item 3.4.1-14 in the LRA (and hence to AMR Item 14 of GALL Report, Volume 1, Table 4) was that for stainless steel primary sampling system piping that is included in LRA Table 3.3.2-4 of the LRA and that, since the material, environment, and aging effect for this commodity group (which is assessed in an AMR a the top of LRA Page 3.3-142) was the same as those assessed for the rolled up piping commodity group in AMR Item 3.4.1-14 in LRA Table 3.4.1, it was appropriate to align the AMR on cracking due to SCC of the stainless steel primary sampling system piping to AMR Item 3.4.1-14.

The AMR provided in AMR Item 3.4.1-14 is the applicant's AMR that corresponds to the AMR for stainless steel components in AMR Item 14 of GALL Report, Volume 1, Table 4. This AMR in the GALL Report, Volume 1, invokes component-specific Type 2 AMRs in GALL Report, Volume 2, Section VIII, for managing cracking due to SCC in stainless steel piping, piping components, piping elements, tanks and heat exchanger components of the main steam, feedwater, steam generator blowdown, condensate, and auxiliary feedwater systems that are exposed to a treated water environment. The staff reviewed GALL Report, Volume 2, Sections VII and VIII, and noted that the GALL Report does not include any applicable AMR tables for primary sampling system commodity groups. Based on this fact, the applicant may align an AMR for a particular primary sampling system component or commodity group to another AMR in the AMR tables of the GALL Report, Volume 1 or 2, if the materials of fabrication, environmental conditions, and aging effects are the same as those for the analogous commodity group analyzed for in the GALL Report.

The staff has verified that the primary sampling system piping referred to in the applicant's response to RAI 3.4-11 and in LRA Table 3.4.2-4 are fabricated from the same material and are exposed to the same type of environment as that analyzed for in AMR Item 14 of GALL Report, Volume 1, Table 4, environment, and, consistent with the analysis given in this GALL AMR, that the applicant has identified that cracking due to SCC is an applicable aging effect requiring management for the stainless steel piping surfaces that are exposed to a treated water environment. Based on this verification, the staff concludes that the applicant has provided an acceptable basis for aligning the AMR on cracking due to SCC of this primary sampling system piping commodity group to the staff's generic analysis and recommendations in AMR Item 14 of GALL Report, Volume 1, Table 4.

The staff has also verified that, consistent with the analysis and recommendations in AMR Item 14 of GALL Report, Volume 2, Table 4, the applicant has credited the Water Chemistry Program to manage cracking due to SCC in the stainless steel primary sampling system component surfaces that are exposed to the treated water environment, and has credited the One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in preventing or mitigating this aging effect from occurring. The staff concludes that this is acceptable because the applicant has provided a valid basis for aligning the applicable AMR on the stainless steel primary sampling system piping to AMR Item 14 of GALL Report, Volume 2, Table 4, and because the AMPs credited to manage cracking due to SCC in these components are consistent with the AMPs that are recommended for aging management in AMR Item 14 of GALL Report, Volume 2, Table 4.

Based on its review, the staff finds the applicant's response to RAI 3.4-11 acceptable. The staff's concern described in RAI 3.4-11 is resolved.

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 3.4.2.2.7.1 addresses loss of material due to pitting and crevice corrosion in stainless steel, aluminum, and copper alloy components exposed to treated water, stating that a combination of the Water Chemistry Program and the One-Time Inspection Program manages piping components and the Condensate Storage Tank exposed to treated water. The Water Chemistry Program monitors and controls water chemistry using site procedures and processes to prevent or mitigate cracking and loss of material aging effects. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.7.1 is SRP-LR Section 3.4.2.2.7, Item (1). SRP-LR Section 3.4.2.2.7, Item (1), 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.

SRP-LR Section 3.4.2.2.7, Item (1) invokes by reference AMR Items 6, 15, and 16 in GALL Report, Volume 1, Table 4. AMR Item 3.4.1-6, -15, and -16 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Items 6, 15, and 16 in GALL Report, Volume 1, Table 4, are applicable to the LRA. In the discussion columns of AMR Items 3.4.1-6, 3.4.1-15, and 3.4.1-16, the applicant stated that HNP manages loss of material due to general (steel only), pitting, and crevice corrosion of steel, aluminum, copper alloy, and stainless steel components and tanks exposed to treated water with a combination of the Water Chemistry Program and the One-Time Inspection Program consistent with the GALL Report. The applicant clarified that it has aligned this AMR to the management of loss of material due to general, pitting, and crevice corrosion in steel and stainless steel piping, piping components, and piping components in the steam turbine system, main steam system, feedwater system, condensate system, steam generator blowdown system, and auxiliary feedwater system, and for the condensate storage tank. This is consistent with AMR Items 6, 15, and 16 in GALL Report, Volume 1, Table 4, and is acceptable.

The staff reviewed the Water Chemistry Program, which monitors chlorides, fluorides, and dissolved oxygen to limit the contaminants thus minimizing the occurrences of aging effects and maintaining component ability to perform intended functions. The staff also verified that the applicant is crediting its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program and to confirm that loss of material has not occurred in these piping, tank, and heat exchangers components. The staff also verified that the applicant's One-Time Inspection Program includes applicable criteria and program elements for the inspection of these piping, tank, and heat exchanger components to monitor for loss of material. Based on this review, the staff finds that these programs include activities that are consistent with recommendations in the GALL Report, and are adequate to manage loss of material due to general (steel only), pitting, and crevice corrosion on internal surfaces of steel and stainless steel piping, piping components, piping elements, tanks, and heat exchanger components that are exposed to treated water.

The staff noted that the applicant states that the steam and power conversion systems do not contain aluminum or copper alloy components exposed to treated water. However, the staff noted that the applicant has aligned its AMRs on loss of material due to general, pitting, and crevice corrosion for the copper alloy piping, piping components, and piping elements in the boron thermal regeneration and demineralized water systems (*i.e.,* auxiliary system components) to AMR Item 3.4.1-15, which is a steam and power conversion system AMR. The staff also noted that the applicant has also aligned its AMRs on loss of material due to general, pitting, and crevice corrosion in the stainless steel piping, piping components, and piping elements in the demineralized water, radiation monitoring, radwaste sampling, and refueling systems (*i.e.,* auxiliary system components), and the stainless steel steam generator instrument manifolds and valves and miscellaneous stainless steel non-pressure boundary components in the steam generator system to AMR Item 3.4.1-16. The applicant has credited the One-Time Inspection Program and the Water Chemistry Program to manage loss of material in these auxiliary system and steam generator system components.

The staff's review of LRA Section 3.4.2.2.7 identified an area in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.4-12 dated January 7, 2008, the staff asked the applicant to provide its basis for: (1) aligning the Type 2 AMR items on loss of material of the copper alloy piping components in the boron thermal regeneration and demineralized water systems to LRA AMR Item 3.4-1-15, and (2) aligning the Type 2 AMR items for stainless steel piping components in the radiation monitoring, radwaste sampling, and refueling systems, stainless steel steam generator instrument manifolds and valves, and miscellaneous stainless steel non-pressure boundary components in the steam generator system to this AMR Item 3.4.1-16. The staff also asked the applicant to justify its basis for crediting the One-Time Inspection Program and the Water Chemistry Program to manage loss of material due to general, pitting, or crevice corrosion in these components in lieu of performing periodic inspections of the components.

In its response dated January 17, 2008, the applicant clarified that the stated AMRs for stainless steel commodity groups in the applicant's Type 2 AMR tables for the steam generator system, demineralized water system, radiation monitoring system, radwaste sampling system, and refueling system were aligned to AMR Item 3.4.1-16 (and hence to AMR Item 16 in GALL Report, Volume 1, Table 4) because the components are subject to the same material, environment, and aging effect combinations as those analyzed for in the GALL AMR. The applicant also clarified that, consistent with this determination, it is valid to credit the Water Chemistry Program and One-Time Inspection Program to manage loss of material due to general, pitting, and crevice corrosion for the stainless steel component surfaces that are exposed to a treated water environment.

In the response letter date January 17, 2008, the applicant also clarified that the AMRs for copper alloy piping, piping components, and piping elements in the applicant's Type 2 AMR tables for the boron thermal regeneration system and demineralized water system were aligned to AMR Item 3.4.1-15 (and hence to AMR Item 15 in GALL Report, Volume 1, Table 4) because the components are subject to the same material, environment, and aging effect combinations as those analyzed for in the GALL AMR. The applicant also clarified that, consistent with this determination, it is valid to credit the Water Chemistry Program and One-Time Inspection Program to manage loss of material due to general, pitting, and crevice corrosion for the copper alloy component surfaces that are exposed to a treated water environment.

The AMR provided in LRA AMR Item 3.4.1-16 is the applicant's AMR that corresponds to the AMR for stainless steel components in AMR item 16 of GALL Report, Volume 1, Table 4. This AMR in GALL Report, Volume 1, invokes component-specific Type 2 AMRs in GALL Report, Volume 2, Section VIII, for managing loss of material due to general, pitting, and crevice corrosion in particular stainless steel steam piping, piping components, piping elements, tanks and heat exchanger components in the main steam, feedwater, steam generator blowdown, condensate, and auxiliary feedwater systems that are exposed to a treated water environment. These GALL AMRs recommend that the Water Chemistry Program be credited to manage loss of material due to general, pitting, and crevice corrosion in the stainless steel components. The staff concludes that it is acceptable for the applicant to align its AMRs stainless steel piping, piping components, and piping elements in the demineralized water, radiation monitoring, radwaste sampling, and refueling systems (*i.e.*, auxiliary system components), and the stainless steel steam generator instrument manifolds and valves and miscellaneous stainless steel non-pressure boundary components because the commodity groups have the same material, environment, and aging effect combination as that analyzed for in AMR Item 16 of GALL Report, Volume 1, Table 4, and because the applicant has credited the same AMPs for aging management (*i.e.*, the Water Chemistry Program and the One-Time Inspection Program) as are recommended for aging management in this GALL AMR.

Based on its review, the staff finds the applicant's response to RAI 3.4-12 acceptable with respect to the validity of crediting the Water Chemistry Program and One-Time Inspection Program to manage loss of material in these stainless steel components.

The AMR provided in LRA AMR 3.4.1-15 is the applicant's AMR that corresponds to the AMR for stainless steel components in AMR Item 15 of GALL Report, Volume 1, Table 4. This AMR in the GALL Report, Volume 1, invokes component-specific Type 2 AMRs in GALL Report, Volume 2, Section VIII for managing loss of material due to general, pitting, and crevice corrosion in specific copper alloy piping, piping components, and piping elements in the steam turbine system, feedwater system, condensate system, steam generator blowdown, and auxiliary feedwater system that are exposed to treated water. These GALL AMRs recommend that the Water Chemistry Program be credited to manage loss of material due to general, pitting, and crevice corrosion in these copper alloy components. The staff concludes that it is acceptable for the applicant to align its AMRs for the copper alloy piping, piping components, and piping elements in the boron thermal regeneration system and demineralized water system because the commodity groups have the same material, environment, and aging effect combination as that analyzed for in AMR

Item 15 of GALL Report, Volume 1, Table 4, and because the applicant has credited the same AMPs for aging management (*i.e.*, the Water Chemistry Program and the One-Time Inspection Program) as are recommended for aging management in this GALL AMR.

Based on its review, the staff finds the applicant's response to RAI 3.4-12 acceptable with respect to the validity of crediting the Water Chemistry Program and One-Time Inspection Program to manage loss of material in these copper alloy components. The staff's concern described in RAI 3.4-12 is resolved.

(2) LRA Section 3.4.2.2.7.2 addresses loss of material due to pitting and crevice corrosion in stainless steel piping components exposed to soil, stating that this aging effect is not applicable because the auxiliary feedwater and condensate systems have no stainless steel components exposed to soil.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.7.2 is SRP-LR Section 3.4.2.2.7, Item (2). SRP-LR Section 3.4.2.2.7, Item (2), 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.

SRP-LR Section 3.4.2.2.7, Item (2), invokes by reference AMR Item 17 in GALL Report, Volume 1, Table 4, which pertains to loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements in the condensate and auxiliary feedwater systems. AMR Item 3.4.1-17 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 17 in GALL Report, Volume 1, Table 4, is applicable to the LRA. In the discussion column of AMR Item 3.4.1-17, the applicant stated that the condensate and auxiliary feedwater systems do not include any stainless steel piping, piping components, or piping elements that are exposed to a soil environment.

Based on the review of the LRA Tables 3.4.2-1 through 3.4.2-13 and the applicant's supporting documents, the staff verified that steam and power conversion systems do not have stainless steel components that are exposed to soil and subject to an AMR. The staff finds that SRP-LR Section 3.4.2.2.7, Item (2), and AMR Item 17 in GALL Report, Volume 1, Table 14, do not apply to HNP steam and power conversion systems because the condensate and auxiliary feedwater systems do not include any stainless steel piping, piping components, or piping elements that are exposed to a soil environment. There are no stainless steel components exposed to soil in the auxiliary feedwater system and condensate system within the scope of license renewal. Based on this review, the staff concludes that the LRA does not need to include any corresponding AMRs items in the Type 2 AMR tables for these components.

(3) LRA Section 3.4.2.2.7.3 addresses loss of material due to pitting and crevice corrosion in copper alloy piping components exposed to lubricating oil, stating that this aging effect is not applicable because the Condensate System, Feedwater System, Auxiliary Feedwater System, and Turbine System portions within the scope of license renewal have no copper alloy piping components exposed to lubrication oil.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.7.3 is SRP-LR Section 3.4.2.2.7, Item (3). SRP-LR Section 3.4.2.2.7, Item (3), 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.

SRP-LR Section 3.4.2.2.7, Item (3), invokes by reference AMR Item 18 in GALL Report, Volume 1, Table 4, which pertains to loss of material due to pitting and crevice corrosion in copper alloy piping, piping components, and piping elements in the steam turbine, feedwater, condensate, and auxiliary feedwater systems. AMR Item 3.4.1-18 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 18 in GALL Report, Volume 1, Table 4, is applicable to the LRA. In the discussion column of AMR Item 3.4.1-18, the applicant stated that the steam turbine, feedwater, condensate, and auxiliary feedwater systems do not include any copper piping, piping components, or piping elements that are exposed to a lubricating oil environment.

Based on the review of the LRA Tables 3.4.2-1 through 3.4.2-13 and the applicant's supporting documents, the staff verified that steam and power conversion systems do not have copper piping, piping components, or piping elements that are exposed to lubricating oil within the scope of license renewal. The staff finds SRP-LR Section 3.4.2.2.7, Item (3), and AMR Item 17 in GALL Report, Volume 1, Table 14, do not apply to HNP steam and power conversion systems because the condensate and auxiliary feedwater systems do not include and stainless steel piping, piping components, or piping elements that are exposed to a lubricating oil environment. Based on this review, the staff concludes that the LRA does not need to include any corresponding AMRs items in the Type 2 AMR tables for these components.

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 and crevice corrosion and MIC, stating that a combination of the Lubricating Oil Analysis Program and the One-Time Inspection

Program manages Steam and Power Conversion System stainless steel piping and heat exchanger components exposed to lubricating oil. The Lubricating Oil Analysis Program maintains oil systems contaminants (primarily water and particulates) within acceptable limits to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. One-Time Inspection Program inspections either verify that unacceptable degradation has not occurred or trigger additional actions to maintain the intended function(s) of affected components during the period of extended operation.

The section in the SRP-LR that corresponds to LRA Section 3.4.2.2.7.3 is SRP-LR Section 3.4.2.2.8. 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.

SRP-LR Section 3.4.2.2.8 invokes by reference AMR Item 19 in Table 4 of the GALL Report, Volume 1, which pertains to loss of material due to pitting, crevice, and microbiologically-influenced corrosion in stainless steel piping, piping components, piping elements, and heat exchanger components of the steam turbine, feedwater, condensate, and auxiliary feedwater systems that are exposed to lubricating oil. AMR Item 3.4.1-19 in LRA Table 3.4.1 provides the applicant's assessment on whether AMR Item 19 in Table 4 of the GALL Report, Volume 1, is applicable to the LRA. In the discussion column of AMR Item 3.4.1-19, the applicant stated that HNP manages loss of material due to pitting, crevice, and microbiologically-influenced corrosion of stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil with the Lubricating Oil Analysis Program and the One-Time Inspection Program and that this is consistent with the GALL Report.

The staff reviewed the Lubricating Oil Analysis Program, which maintains oil system contaminants, primarily water, and particulate within acceptable limits, thereby preserving an environment that is not conducive to loss of material due to pitting, crevice, and microbiologically-influenced corrosion thus minimizing the occurrences of aging effects and maintaining component ability to perform intended functions. The staff verified that the applicant is crediting its One-Time Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program and to confirm that loss of material due to pitting, crevice, or microbiologically-influenced corrosion is not an applicable aging effect for those stainless steel piping, piping components, piping elements, and heat exchanger components in the steam turbine, feedwater, condensate, and auxiliary feedwater systems that are exposed to lubricating oil. The staff also verified that the applicant's One-Time Inspection Program includes applicable criteria and program elements for the inspection of these components to monitor for loss of material. The staff finds that these programs include activities that are consistent with recommendations in the GALL Report, and are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion of stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil in the steam and power conversion systems. The staff evaluated the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluation is documented in sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.8 criteria. For those line items that apply to LRA Section 3.4.2.2.8, 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).

3.4.2.2.9 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, stating that this aging effect is not applicable because condensate system heat exchanger components exposed to treated water are not within the scope of license renewal.

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 of BWRs that are exposed to treated water. SRP-LR Section 3.4.2.2.9 invokes by reference AMR Item 6 in Table 4 of the GALL Report, Volume 1. This AMR item is applicable to BWR heat exchanger components in the steam and power conversion systems of BWRs. The staff concludes that this AMR item is not applicable to HNP because HNP is a PWR.

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 3.4.2-13, 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 3.4.2-13, 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.

3.4.2.3.1 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Steam Generator Blowdown 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 steam generator blowdown system component groups.

The results of these evaluations are all consistent with 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).

3.4.2.3.2 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Steam Generator Chemical Addition 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 steam generator chemical addition system component groups.

In Table 3.4.2-2, the applicant annotated Note J for carbon steel piping, piping components, and piping elements exposed to treated water (inside) environment in the steam generator chemical addition system because neither the component nor the material and environment combination is evaluated in the GALL Report. The staff reviewed the GALL Report and concluded that the AMR item, carbon or low alloy steel piping, piping components, and piping elements is not evaluated for treated water (inside) environment and accordingly Note J is appropriate for this component, material, and environment combination. The applicant recommended One-Time Inspection Program to manage loss of material due to crevice, general, and pitting corrosion.

The staff asked the applicant to justify the use of One-Time Inspection Program to manage the aging effect of loss of material due to crevice, general, and pitting corrosion. The applicant responded in a letter dated August 20, 2007 and stated that this item represented piping components that are water filled but no longer in service. The applicant clarified that the water source is from treated water loss of material resulting from either general corrosion, pitting corrosion, or crevice corrosion is not expected to occur, but current data are insufficient to rule it out with reasonable confidence. The staff informed the applicant that the One-Time Inspection Program is to verify the effectiveness of another AMP and confirm the insignificance of an aging effect. The applicant agreed to amend the LRA and credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the loss of material due to crevice, general, and pitting corrosion in the steel (*i.e.,* carbon steel and low alloy steel) components of the steam generator chemical addition system that are exposed to treated water. The staff concludes that this is acceptable because it is consistent with other AMR (e.g., refer to AMR Items VII.G-23 or VIII.B1-7 in the GALL Report, Volume 2) on loss of material due to general, pitting, or crevice corrosion of in steel piping components that are exposed to wetted aqueous conditions (*i.e.,* exposure to condensation or to treated water) and because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program proposes periodic visual examinations of the internal surfaces to monitor for evidence of corrosion.

The staff verified that the applicant made the applicable amendment to the LRA by letter dated August 20, 2007. The staff finds that this program includes activities that are consistent with recommendations in the GALL Report, AMP XI.M38, and are adequate to manage loss of material due to general, pitting, and crevice corrosion of steel (*i.e.,* carbon steel, alloy steel, and cast iron) piping, piping components, and piping elements exposed to treated water (inside) environment in the steam and power conversion systems. The staff evaluated the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.7.

In its response dated January 17, 2008, the applicant confirmed that it had amended the application accordingly in the applicant letter dated August 20, 2007 and, that in this LRA amendment, the applicant had amended the application to credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to general, pitting, and crevice corrosion of the steel (i.e. carbon steel or alloy steel) piping, piping components, and piping elements in the steam generator chemical addition system that are exposed to a treated water environment. The staff's concern described in RAI 3.4-1 is resolved.

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 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Main Steam Supply 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 main steam supply system component groups.

In Table 3.4.2-3, the applicant annotated Note F for its AMR on elastomeric piping, piping components, and piping elements in the main steam system under exposure to an air - indoor (outside) environment because the material is not in the GALL Report for this component, material, and environment combination. The applicant credited External Surfaces Monitoring Program to manage the cracking and changes in material properties as a result of various degradation mechanisms.

The staff informed the applicant that the External Surfaces Monitoring Program may not be an acceptable program to manage cracking and changes in material properties of elastomeric components that are exposed to an air - indoor (outside) environment.

The staff's review of LRA Section 3.4.2.3.3 identified areas in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.4-2, Parts A and B, dated January 7, 2008, the staff asked the applicant to: (1) identify the material properties that could be impacted in these elastomeric components and clarify whether any material property analyses have been performed to demonstrate how these elastomeric materials would behave in an air - indoor environment, and (2) justify why it considers the External Surfaces Monitoring Program to be capable of managing both cracking and changes in the materials properties of those elastomeric piping, piping components, and piping elements in the main steam system that are exposed to an air - indoor (outside) environment.

In its response to RAI 3.4-2, Part B, dated January 17, 2008, the applicant stated that the impacted materials properties are hardening and loss of strength and clarified that changes in these material properties can occur if elastomeric piping components in the main steam system and feedwater system are subjected to temperatures in excess of 35°C (95°F) or to ozone, other oxidizing reagents or compounds, or radiation. The applicant identified that the following aging effects may occur in these materials that are indicative of changes in these material properties: (1) cracking, (2) crazing, (3) fatigue breakdown, (4) abrasion, (5) chemical attacks [i.e. chemical reactions], or (6) weathering. The applicant stated that it had performed a review of the industry OE databases for OE related to failures in elastomeric components (rubber materials, neoprene rubbers, silicone rubbers) and that the OE review had indicated that most of the industry failures were associated with piping, penetration, and equipment sealant failures. As a result of its review, the applicant stated that it had identified changes in material properties and cracking as applicable aging effects requiring management for the applicable AMRs for the elastomeric piping components in the main steam and feedwater systems that are exposed to indoor air.

The piping components addressed in RAI 3.4-2, Parts A and B, are flexible rubber hoses that are designed with considerable elastic properties. GALL Report Table IX.C, "Selected Definitions & Use of Terms for Describing and Standardizing - MATERIALS," identifies that these materials may harden (lose their flexibility) and lose some of their elastic strength when subject to temperatures in excess of 35°C (95°F) or when exposed to ozone, other oxidizing compounds, or radiation. GALL AMR Item VII.F-4 identifies that hardening and loss of strength are applicable aging effects for elastomeric components that are exposed to an indoor uncontrolled air environment. Thus, the applicant's AMR is acceptable because it is: (1) consistent with the aging effects identified in GALL AMR Item VII.F-4 for elastomeric materials that are exposed to an external indoor air environment, and (2) more conservative than GALL AMR Item VII.F-4 in that the applicant's AMR conservatively adds cracking as an AERM for these elastomeric main steam and feedwater piping components.

Based on its review, the staff finds the applicant's response to RAI 3.4-2, Part A, acceptable. The staff's concern described in RAI 3.4-2 is resolved with respect to the applicant's response to Part A of the staff's question.

In its response to RAI 3.4-2, Part B, dated January 17, 2008, the applicant clarified that the External Surfaces Monitoring Program will be credited to manage changes in material properties and cracking in the external elastomeric piping surfaces that are exposed to the indoor air environment. The applicant clarified that the program implements system walkdowns to monitor to degradation on the external surfaces of plant components. The applicant clarified that the HNP procedure for these walkdowns includes guidance for engineers of plant inspection personnel to perform periodic inspections to monitor for evidence of aging or cracking in plastic, rubber, or elastomeric components. The applicant clarified that it had evaluated the program elements for its External Surfaces Monitoring Program and that it determined that an enhancement of the program was necessary to ensure detection of aging in these elastomeric components. The applicant stated that the necessary enhancement is included in LRA Commitment No. 18, which was provided in the applicant's letter dated November 14, 2006.

The AMP in the GALL Report that corresponds to the applicant's External Surfaces Monitoring Program is GALL AMP XI.M36, "External Surfaces Monitoring." The staff reviewed the program description and program elements for GALL AMP XI.M36 and determined that the scope of the GALL AMP pertains to the external surfaces of steel components in systems that are within the scope of license renewal and are subject to AMRs for loss of material and leakage, and does not apply to elastomeric components or to the management of cracking or material properties in elastomeric components. Thus, the staff determined that the applicant was applying the scope of its External Surfaces Monitoring Program to components materials and aging effects in which GALL AMP XI.M36, "Externals Surfaces Monitoring," does not apply. Therefore, the staff reviewed LRA Commitment No. 18 to determine whether the applicant had committed to specific activities for elastomeric piping that could be subject to NRC review and approval through one of the NRC's established review processes. The staff determined that Commitment No. 18, committed to the following action for inspection of elastomeric piping under the External Surfaces Monitoring Program:

> The program will be enhanced to: . . . (4) provide specific guidance for visual inspections of elastomers for cracking, chafing, or changes in material properties due to wear, ...

Thus, while the staff did verify the applicant's enhancement of the External Surfaces Monitoring Program, as given in Commitment No. 18, did include commitment provisions for these elastomeric components, the staff noted that the enhancement was made on a matter that is not specifically addressed in AMP XI.M36 of the GALL Report and that the enhancement did not provide any provision that the specific guidance for these elastomeric components (when developed) would be submitted for NRC review and approval. Thus, the staff noted the applicant's enhancement of the External Surfaces Monitoring Program, as currently worded in

Commitment No. 18, effectively removed the NRC from its review and approval process on the inspection methods and criteria that would be used to manage changes in materials properties and cracking in these elastomeric components. As a result the issue of whether or not the External Surfaces Monitoring Program can be used to manage changes in material properties and cracking in these components remains open and the staff's resolution of the issue raised in RAI 3.4-2, Part B, is still pending. The staff discussed the issue with the applicant on a conference call and it was agreed that these components will be placed in a Preventive Maintenance Program with periodic replacement. The applicant agreed to provide this in a docketed correspondence. This was CI 3.4-1.

In a letter dated April 23, 2008, the applicant stated, with the exception of the thermoplastic diaphragm used in the design of the condensate storage tank (CST), the elastomeric and polymeric components identified in RAIs 3.4-2, 3.4-3, 3.4-4, 3.4-5, 3.4-7 and 3.4-8 will be treated as consumables that are evaluated and periodically replaced under the applicant's preventative maintenance program (see Commitment No. 36). As a result of this change, these elastomeric or thermoplastic components will not be required to remain screened in as being within the scope of an aging management review because the components would be periodically replaced and no longer categorized as passive, long-lived components.

Based on this review, the staff finds that the applicant has appropriately addressed the elastomeric and thermoplastic components in the steam and power conversion systems. Confirmatory Item 3.4-1 is closed.

In Table 3.4.2-3, the applicant annotated Note F for its AMR on PVC or thermoplastic piping, piping components, and piping elements in the main steam system under exposure to a radiation (ultraviolet) (outside) environment because the material is not in the GALL Report for this component, material, and environment combination. The applicant identified cracking and changes in material properties are applicable aging effects requiring management for these components and credited the External Surfaces Monitoring Program to manage the aging effects.

In RAI 3.4-3, Parts A and B, dated January 7, 2008, the staff informed the applicant that the External Surfaces Monitoring Program may not be an acceptable program to manage cracking and changes in material properties of thermoplastic (including polyvinyl chloride [PVC]) components that are exposed to a radiation (ultraviolet, outside) environment. The staff asked the applicant to identify which materials properties would be impacted in these thermoplastic components and to justify why it considers the External Surfaces Monitoring Program to be capable of managing both cracking and changes in the materials properties of those thermoplastic piping, piping components, and piping elements in the main steam system that are exposed to the radiation (ultraviolet, outside) environment.

In its response dated January 17, 2008, the applicant stated that changes in the fracture toughness (i.e. embrittlement) of the thermoplastic materials is the applicable material property that would result from irradiation of the thermoplastic materials, and that the applicant would enhance its External Surfaces Monitoring Program to establish the inspection methods and acceptance criteria for these thermoplastic components (*i.e.,* the thermoplastic breather caps in the main steam power-operated relief valve (PORV) actuators and the thermoplastic tubing in the secondary sampling system).

The AMP in the GALL Report that corresponds to the applicant's External Surfaces Monitoring Program is GALL AMP XI.M36, "External Surfaces Monitoring." The staff reviewed the program description and program elements for GALL AMP XI.M36 and determined that the scope of the GALL AMP pertains to the external surfaces of steel components in systems that are within the scope of license renewal and are subject to AMRs for loss of material and leakage, and does not apply to thermoplastic components or to the management of cracking or material properties in thermoplastic components. Thus, the staff determined that the applicant was applying the scope of its External Surfaces Monitoring Program to components materials and aging effects in which GALL AMP XI.M36, "Externals Surfaces Monitoring," does not apply. Therefore, the staff reviewed LRA Commitment No. 18 to determine whether the applicant had committed to specific activities for elastomeric piping that could be subject to NRC review and approval through one of the NRC's established review processes. The staff determined that Commitment No. 18, committed to the following action for inspection of thermoplastic components under the External Surfaces Monitoring Program:

> The program will be enhanced to: . . . (4) provide specific guidance for visual inspections of elastomers for cracking, chafing, or changes in material properties due to wear, ...

Thus, while the staff did verify the applicant's enhancement of the External Surfaces Monitoring Program, as given in Commitment No. 18, did include commitment provisions for these elastomeric components, the staff noted that the enhancement: (1) did not specifically reference thermoplastic materials, (2) was made on a matter that is not specifically addressed in AMP XI.M36 of the GALL Report, and (3) did not provide any provision that the specific inspection methods and acceptance criteria for these thermoplastic components (when developed) would be submitted for NRC review and approval. Thus, staff noted the applicant's enhancement of the External Surfaces Monitoring Program, as currently worded in Commitment No. 18, did not specifically mention thermoplastic components, and even if it did, the wording would effectively remove the NRC from its review and approval process on the inspection methods and acceptance criteria that would be used to manage changes in materials properties and cracking in these thermoplastic components. As a result the issue of whether or not the External Surfaces Monitoring Program can be used to manage changes in material properties and cracking in these components remains open and the staff's resolution of the issue raised in RAI 3.4-3, Part B is still pending. The staff discussed the issue with the applicant on a conference call and it was agreed that these components will be placed in a Preventive Maintenance Program with periodic replacement. The applicant agreed to provide this in a docketed correspondence. This was CI 3.4-1.

In letter dated April 23, 2008, the applicant stated, with the exception of the thermoplastic diaphragm used in the design of the condensate storage tank (CST), the elastomeric and polymetric components identified in RAIs 3.4-2, 3.4-3, 3.4-4, 3.4-5, 3.4-7 and 3.4-8 will be treated as consumables that are evaluated and periodically replaced under the applicant's preventative maintenance program (see Commitment No. 36). As a result of this change, these elastomeric or thermoplastic components will not be required to remain screened in as being within the scope of an aging management review because the components would be periodically replaced and no longer categorized as passive, long-lived components.

Based on this review, the staff finds that the applicant has appropriately addressed the elastomeric and thermoplastic components in the steam and power conversion systems. Confirmatory Item 3.4-1 is closed.

In Table 3.4.2-3, the applicant annotated Note F for its AMR on PVC or thermoplastic piping, piping components, and piping elements in the main steam supply system under exposure to a lubricating oil or hydraulic fluid (inside) environment because the material is not in the GALL Report for this component, material, and environment combination. The applicant credited no AMP for lubricating oil or hydraulic fluid (inside) environment as there are no aging effects requiring management.

In RAI 3.4-4 dated January 7, 2008, the staff informed the applicant the thermoplastic materials (including PVC) may be capable of being dissolved by organic oils or hydraulic fluids and asked the applicant to provide its basis why loss of material from dissolving is not considered to be an applicable aging effect requiring management for surfaces of thermoplastic (including PVC) piping, piping components and piping elements in the main steam supply system that are exposed to an oil or organic hydraulic fluid environment.

In its response dated January 17, 2008, the applicant clarified that the component surfaces addressed in RAI 3.4-4 are the surfaces of thermoplastic breather caps in the PORV actuators that are exposed to a phosphate ester hydraulic fluid mist. The applicant clarified the applicant's operating experience review did not identify aging applicable operating experience on degradation of these type of thermoplastic breather caps under exposure to a phosphate ester hydraulic fluid environment, and that as a result of this determination, the applicant did not identify any applicable aging effects for the thermoplastic component surfaces that are exposed to the hydraulic fluid environment.

The staff noted that the applicant's response to RAI 3.4-4: (1) did not cite any industry documents or academic literature to support the applicant's determination that aging effects are not be applicable for the specific thermoplastic breather cap material that is exposed to the phosphate ester hydraulic fluid environment, and (2) did not credit a One-Time Inspection to verify that aging effects or changes in material properties are not occurring (*i.e.,* chemical reactions, cracking, loss of fracture toughness or strength) in the surfaces of the breather caps that are exposed to the hydraulic fluid environment. Thus, the staff finds that the applicant response to RAI 3.4-4 did not provide a sufficient basis for its determination that aging effects are not applicable to the thermoplastic breather cap surfaces that are exposed to the hydraulic fluid environment. The staff's resolution of this issue raised in RAI 3.4-4 is pending. The staff discussed the issue with the applicant on a conference call and it was agreed that this component will be placed in a Preventive Maintenance Program with periodic replacement. The applicant agreed to provide this in a docketed correspondence. This was CI 3.4-1.

In letter dated April 23, 2008, the applicant stated, with the exception of the thermoplastic diaphragm used in the design of the condensate storage tank (CST), the elastomeric and polymetric components identified in RAIs 3.4-2, 3.4-3, 3.4-4, 3.4-5, 3.4-7 and 3.4-8 will be treated as consumables that are evaluated and periodically replaced under the applicant's preventative maintenance program (see Commitment No. 36). As a result of this change, these elastomeric or thermoplastic components will not be required to remain screened in as being within the scope of an aging management review because the components would be periodically replaced and no longer categorized as passive, long-lived components.

Based on this review, the staff finds that the applicant has appropriately addressed the elastomeric and thermoplastic components in the steam and power conversion systems. Confirmatory Item 3.4-1 is closed.

In Table 3.4.2-3, the applicant annotated Note F for its AMR on loss of material due to pitting and crevice corrosion in aluminum or aluminum alloy piping, piping components, and piping elements exposed in the main steam system under exposure to the hydraulic fluid (inside) environment because the material is not in the GALL Report for this component, material, and environment combination. The applicant credited Lubricating Oil Analysis and One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion since both the lubricating oil and the hydraulic fluid are hydrocarbon-based fluids and the analysis of hydraulic fluid and lubricating oils are performed using similar predictive maintenance processes and procedures.

The staff reviewed the Lubricating Oil Analysis Program, which maintains oil system contaminants primarily water and particulate within acceptable limits. The staff determined that the Lubricating Oil Analysis Program is applicable to HNP components that are exposed to either lubricating oil or hydraulic fluid and that the program is designed to prevent or mitigate the effects of corrosion, including loss of material due to pitting and crevice corrosion, thus minimizing the occurrences of aging effects and maintaining the components' ability to perform their intended functions. The staff verified that the applicant's the One-Time Inspection Program is credited to verify the effectiveness of the Lubricating Oil Analysis Program and to confirm that loss of material due general, pitting or crevice corrosion is not an applicable aging effect for the surfaces of components that are exposed to lubricating oil or hydraulic fluid. The staff also verified that the scope of the One-Time Inspection Program does includes one-time examinations of the metallic piping components that are exposed to lubricating oil or hydraulic fluid.

The staff finds that it is acceptable to credit the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage loss of material due to general corrosion in these components because it is consistent with other AMRs (e.g., refer to AMR Item VIII.D1-2 in the GALL Report, Volume 2) on loss of material due to general, pitting, or crevice corrosion in metallic piping components under exposure to a lubricating oil or hydraulic fluid environment and because the One-Time Inspection Program will verify the effectiveness of the Lubricating Oil Analysis Program to prevent or mitigate corrosion in these aluminum components and to verify that loss of material resulting from pitting or crevice corrosion is not an applicable aging effect for these aluminum components under exposure to either lubricating oil or hydraulic fluid.

As such, the staff concludes that it is acceptable for the applicant to credit the Lubricating Oil Analysis Program and One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion of aluminum or aluminum alloys piping, piping components, and piping elements in the main steam system under exposure to lubricating oil or hydraulic fluid because it is consistent with the recommended AMR in GALL AMR Item VIII.D1-2. The staff evaluated the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

In Table 3.4.2-3, the applicant annotated Note G for its AMR on loss of material in carbon or alloy steel piping, piping components, and piping elements in the main steam system under exposure to a lubricating oil or hydraulic fluid (inside) environment because the environment is not in the GALL Report for this component, material, and environment combination. The applicant credited Lubricating Oil Analysis and One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion since both the lubricating oil and the hydraulic fluid are hydrocarbon-based fluids and the analysis of hydraulic fluid and lubricating oils are performed using similar predictive maintenance processes and procedures.

The staff reviewed the Lubricating Oil Analysis Program, which maintains oil system contaminants primarily water and particulate within acceptable limits. The staff determined that the Lubricating Oil Analysis Program is applicable to HNP components that are exposed to either lubricating oil or hydraulic fluid and that the program is designed to prevent or mitigate the effects of corrosion, including loss of material due to pitting and crevice corrosion, thus minimizing the occurrences of aging effects and maintaining the components' ability to perform their intended functions. The staff verified that the applicant's the One-Time Inspection Program is credited to verify the effectiveness of the Lubricating Oil Analysis Program and to confirm that loss of material due general, pitting or crevice corrosion is not an applicable aging effect for the surfaces of components that are exposed to lubricating oil or hydraulic fluid. The staff also verified that the scope of the One-Time Inspection Program does includes one-time examinations of the metallic piping components that are exposed to lubricating oil or hydraulic fluid.

The staff finds that it is acceptable to credit the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage loss of material due to general corrosion in these components because it is consistent with other AMRs (e.g., refer to AMR Item VIII.D1-6 in the GALL Report, Volume 2) on loss of material due to general, pitting, or crevice corrosion in steel (i.e, carbon steel or low alloy steel or cast iron) piping components under exposure to a lubricating oil or hydraulic fluid environment and because the One-Time Inspection Program will verify the effectiveness of the Lubricating Oil Analysis Program to prevent or mitigate corrosion in these components and to verify that loss of material resulting from pitting or crevice corrosion is not an applicable aging effect for these components under exposure to either lubricating oil or hydraulic fluid. As such, the staff concludes that it is acceptable for the applicant to credit the Lubricating Oil Analysis Program and One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion of steel (i.e, carbon steel or low alloy steel or cast iron) piping, piping components, and piping elements in the main steam system under exposure to lubricating oil or hydraulic fluid because it is consistent with the recommended AMR in GALL AMR Item VIII.D1-6. The staff evaluated the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

In Table 3.4.2-3, the applicant annotated Note G for its AMR on loss of material due to pitting and crevice corrosion in copper alloy (greater than 15 percent zinc) piping, piping components, and piping elements of the main steam system under exposure exposed to a lubricating oil or hydraulic fluid (inside) environment because the environment is not in the GALL Report for this component, material, and environment combination. The applicant credited Lubricating Oil Analysis and One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion since both the lubricating oil and the hydraulic fluid are hydrocarbon-based fluids and the analysis of hydraulic fluid and lubricating oils are performed using similar predictive maintenance processes and procedures.

The staff reviewed the Lubricating Oil Analysis Program, which maintains oil system contaminants primarily water and particulate within acceptable limits. The staff determined that the Lubricating Oil Analysis Program is applicable to HNP components that are exposed to either lubricating oil or hydraulic fluid and that the program is designed to prevent or mitigate the effects of corrosion, including loss of material due to pitting and crevice corrosion, thus minimizing the occurrences of aging effects and maintaining the components' ability to perform their intended functions. The staff verified that the applicant's the One-Time Inspection Program is credited to verify the effectiveness of the Lubricating Oil Analysis Program and to confirm that loss of material due general, pitting or crevice corrosion is not an applicable aging effect for the surfaces of components that are exposed to lubricating oil or hydraulic fluid. The staff also verified that the scope of the One-Time Inspection Program does include one-time examinations of the metallic piping components that are exposed to lubricating oil or hydraulic fluid.

The staff finds that it is acceptable to credit the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage loss of material due to general corrosion in these components because it is consistent with other AMRs (e.g., refer to AMR Item VIII.D1-2) on loss of material due to general, pitting, or crevice corrosion in copper alloy (greater than 15 percent zinc) piping components under exposure to a lubricating oil or hydraulic fluid environment and because the One-Time Inspection Program will verify the effectiveness of the Lubricating Oil Analysis Program to prevent or mitigate corrosion in these components and to verify that loss of material resulting from pitting or crevice corrosion is not an applicable aging effect for these components under exposure to either lubricating oil or hydraulic fluid.
As such, the staff concludes that it is acceptable for the applicant to credit the Lubricating Oil Analysis Program and One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion of copper alloy (greater than 15 percent zinc) piping, piping components, and piping elements in the main steam system under exposure to lubricating oil or hydraulic fluid because it is consistent with the recommended AMR in GALL AMR Item VIII.D1-2. The staff evaluated the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

In Table 3.4.2-3, the applicant annotated Note G for its AMR on loss of material due to pitting or crevice corrosion in stainless steel piping, piping components, and piping elements of the main steam system under exposure to a lubricating oil or hydraulic fluid (inside) environment because the environment is not in the GALL Report for this component, material, and environment combination. The applicant credited the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion since both the lubricating oil and the hydraulic fluid are hydrocarbon-based fluids and the analysis of hydraulic fluid and lubricating oils are performed using similar predictive maintenance processes and procedures.

The staff reviewed the Lubricating Oil Analysis Program, which maintains oil system contaminants, primarily water, and particulate within acceptable limits. The staff determined that the Lubricating Oil Analysis Program is applicable to HNP components that are exposed to either lubricating oil or hydraulic fluid and that the program is designed to prevent or mitigate the effects of corrosion, including loss of material due to pitting and crevice corrosion, thus minimizing the occurrences of aging effects and maintaining the components' ability to perform their intended functions. The staff verified that the applicant's the One-Time Inspection Program is credited to verify the effectiveness of the Lubricating Oil Analysis Program and to confirm that loss of material due general, pitting or crevice corrosion is not an applicable aging effect for the surfaces of components that are exposed to lubricating oil or hydraulic fluid. The staff also verified that the scope of the One-Time Inspection Program does includes one-time examinations of the metallic piping components that are exposed to lubricating oil or hydraulic fluid. The staff finds that it is acceptable to credit the Lubricating Oil Analysis Program and the One-Time Inspection Program to manage loss of material due to general corrosion in these components because it is consistent with other AMRs (e.g., refer to AMR Item VIII.D1-3) on loss of material due to general, pitting, or crevice corrosion in stainless steel piping components under exposure to a lubricating oil or hydraulic fluid environment and because the One-Time Inspection Program will verify the effectiveness of the Lubricating Oil Analysis Program to prevent or mitigate corrosion in these components and to verify that loss of material resulting from pitting or crevice corrosion is not an applicable aging effect for these components under exposure to either lubricating oil or hydraulic fluid.

As such, the staff concludes that it is acceptable for the applicant to credit the Lubricating Oil Analysis Program and One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion of stainless steel piping, piping components, and piping elements in the main steam system under exposure to lubricating oil or hydraulic fluid because it is consistent with the recommended AMR in GALL AMR Item VIII.D1-3. The staff evaluated the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

In Table 3.4.2-3, the applicant annotated Note G for its AMR on loss of material due to selective leaching in copper alloy (greater than 15 percent zinc) piping, piping components, and piping elements in the main steam system under exposure to a lubricating oil or hydraulic fluid (inside) environment because the environment is not in the GALL Report for this component, material, and environment combination. The applicant credited Selective Leaching of Materials Program to manage loss of material due selective leaching in these copper alloy (greater than 15 percent zinc) components.

The staff reviewed the Selective Leaching of Materials Program, which ensures the integrity of components and/or commodities made of copper alloy with zinc content greater than 15 percent exposed to hydraulic fluid by making sure that loss of material due to selective leaching is not occurring thereby minimizing the occurrences of aging effects and maintaining component ability to perform intended functions. The staff determined that the applicant's AMR for these components is consistent with other AMRs (e.g., refer to AMR Item VIII.G-22) on loss of material due to selective leaching of copper (greater than 15 percent zinc) piping components under exposure to a lubricating oil or hydraulic fluid environment and that the applicant's Selective Leaching of Materials Program is consistent with the staff's recommended program elements in GALL AMP XI.M33, with an acceptable exception.

As such, the staff concludes that it is acceptable for the applicant to credit the Selective Leaching of Materials Program to manage loss of material due to selective leaching in copper alloy (greater than 15 percent zinc) piping, piping components, and piping elements in the main steam system under exposure to hydraulic fluid because the applicant's AMR is consistent with other AMRs (e.g., refer to AMR Item VIII.G-22) on loss of material due to selective leaching of copper (greater than 15 percent zinc) piping components under exposure to a lubricating oil or hydraulic fluid environment, and because the staff has determined that the applicant's Selective Leaching of Materials Program is consistent with the staff's recommended program elements in GALL AMP XI.M33, with an acceptable exception. The staff evaluated the Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.2.14.

In Table 3.4.2-3, the applicant annotated Note H for its AMR on loss of material due to general corrosion in carbon or low alloy steel piping, piping components, and piping elements in the main steam system under exposure to a to steam (inside) environment because the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant credited its Water Chemistry Program to manage loss of material due to general corrosion in the surfaces of these components that are exposed to a steam (inside) environment.

The staff concludes that it is acceptable for the applicant to credit the Water Chemistry Program to manage loss of material due to general corrosion in the steel main steam line piping components that are exposed to steam because this is identical to GALL Report recommendations in GALL AMP VIII.B1-8 for the same component commodity group/material/environment/aging effect combination and because the staff determined that the applicant's Water Chemistry Program includes program elements and activities that are consistent with the staff's recommendations in GALL AMP XI.M2, "Water Chemistry," and that the program is adequate to manage loss of material due to general corrosion of carbon or low alloy steel piping, piping components, and piping elements in the main steam system that are exposed to a steam (inside) environment. The staff evaluated the Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.1.

In LRA Table 3.4.2-3, the applicant annotated Note J for its AMR on cracking and changes in material properties due to various mechanisms for elastomers piping components, and piping elements in the main steam system under exposure to a lubricating oil or hydraulic fluid (inside) environment because neither the component nor the material and environment combination is evaluated in the GALL Report for this component, material, and environment combination. The applicant credited the One-Time Inspection Program to manage the aging effects cracking and change in material properties due to various degradation mechanisms.

In RAI 3.4-5, Parts A, B, and C, dated January 7, 2008, the staff asked the applicant to: (1) clarify whether loss of material due to dissolving is an applicable aging effect for elastomeric piping component materials that are exposed to either a lubricating oil or hydraulic fluid environment, (2) identify the material properties that could be impacted by exposure of these elastomeric components to either a lubricating oil or hydraulic fluid environment, and (3) justify its basis for using the One-Time Inspection Program to manage cracking and changes in material properties for those elastomeric piping components that are exposed to an oil or hydraulic fluid environment.

In its response to RAI 3.4-5, Parts A and B, dated January 17, 2008, the applicant: (1) clarified that the RAI pertains to the surfaces of the synthetic rubber hoses in the main steam system PORV actuators that are exposed to a phosphate ester hydraulic fluid environment, (2) confirmed that GALL Report does identify that chemical attacks (including dissolution) may be applicable to elastomeric materials, (3) state that the HNP AMR review process did identify changes in material properties and cracking as applicable aging effects for the rubber surfaces that are exposed to hydraulic fluid.

The staff noted that in the applicant's response to RAI 3.4-5, Parts A and B, the applicant did not specifically provide a basis why chemical attacks or dissolution would not occur in the specific elastomeric component material (rubber hose material) that is exposed to a hydraulic fluid environment other than to state that the operating experience review did not identify any experience with elastomeric failures as a result of wear. Wear is a mechanical phenomenon that can result in loss of material if two material surfaces are rubbing or if a liquid or gas environment is flowing past a solid material. However, loss due to chemical attack or dissolution is a mechanism that could potentially lead to loss of material in a component as a result of a chemical reaction between the elastomeric component's material and bathing oil environment; wear between the elastomeric material (i.e rubber hose) surfaces with the oil environment is not necessarily a prerequisite for a chemical reaction to occur between these compounds. Thus, the staff found that the applicant did not provide a sufficient basis to support the conclusion that chemical attacks or dissolution would not occur in the synthetic rubber hose surfaces that are exposed to the hydraulic fluid environment. The staff's resolution of this issue raised in RAI 3.4-5, Parts A and B is pending. The staff discussed the issue with the applicant on a conference call and it was agreed that this component will be placed in a Preventive Maintenance Program with periodic replacement. The applicant agreed to provide this in a docketed correspondence. This was CI 3.4-1.

In its response to RAI 3.4-5, Part C, dated January 17, 2008, the applicant clarified that, while it does not expect cracking or changes in material properties to occur in the synthetic rubber hose surfaces that are exposed to the hydraulic fluid, it is crediting the One-Time Inspection Program to verify that the aging effects of cracking or changes in the material properties of the rubber hoses is not occurring. The staff noted that GALL Program XI.M32, "One-Time Inspection," does not include any monitoring technique recommendations for managing changes that may occur in a component's material properties. The staff also noted that Commitment No. 14 on the LRA, as provided in the applicant's letter dated January 17, 2008, did not provide any provisions to cover inspection plans and methods, and acceptance criteria for the PORV actuator synthetic rubber hoses that are exposed to a phosphate ester-based hydraulic fluid environment, nor did the commitment provide any provisions to provide these inspection methods and acceptance criteria to the staff for review and approval. Thus, the staff noted the applicant's enhancement of the One-Time Inspection Program, as currently worded in Commitment No. 14, would effectively remove the NRC from its review and approval process on the inspection methods and acceptance criteria that would be used to manage any potential changes in materials properties and cracking in these elastomeric piping components/elements. As a result, the staff's inquiry raised in RAI 3.4-5, Part C is still pending. The staff discussed the issue with the applicant on a conference call and it was agreed that this component will be placed in a Preventive Maintenance Program with periodic replacement. The applicant agreed to provide this in a docketed correspondence. This was CI 3.4-1.

In letter dated April 23, 2008, the applicant stated, with the exception of the thermoplastic diaphragm used in the design of the condensate storage tank (CST), the elastomeric and polymetric components identified in RAIs 3.4-2, 3.4-3, 3.4-4, 3.4-5, 3.4-7 and 3.4-8 will be treated as consumables that are evaluated and periodically replaced under the applicant's preventative maintenance program (see Commitment No. 36). As a result of this change, these elastomeric or thermoplastic components will not be required to remain screened in as being within the scope of an aging management review because the components would be periodically replaced and no longer categorized as passive, long-lived components.

Based on this review, the staff finds that the applicant has appropriately addressed the elastomeric and thermoplastic components in the steam and power conversion systems. Confirmatory Item 3.4-1 is closed.

In Table 3.4.2-3, the applicant annotated Note J for its AMR for piping insulation in the main steam system under exposure to air-indoor (outside) environment because neither the component nor the material and environment combination is evaluated in the GALL Report. The applicant did not credit any AMPs for aging management of these insulation components because the applicant concluded in its AMR that there are not any applicable aging effects for piping insulation under exposure to an air-indoor (outside) environment.

In its review, the staff has verified that the GALL Report does not include any AMRs on aging of insulation materials under exposure to air environments and currently, there is not any relevant industry experience on degradation of insulation materials under exposure to air environments. Based on this review, the staff concludes that it is valid to conclude that there are not any applicable aging effects for the piping insulation that is exposed to the air-indoor (outside) environment and that the LRA does not need to identify any applicable aging effects for this component/ material/environment combination.

On the basis of its review, and with resolution of CI 3.4-1, 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 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Steam Dump 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 steam dump system component groups.

In Table 3.4.2-4, the applicant annotated Note H for its AMR on loss of material due to general corrosion in carbon or low alloy steel piping, piping components, and piping elements of the steam dump system under exposure to a steam (inside) environment because the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant credited the Water Chemistry Program to manage loss of material due to general corrosion in the surfaces of these components that are exposed to a steam (inside) environment.

The staff concludes that it is acceptable for the applicant to credit the Water Chemistry Program to manage loss of material due to general corrosion in the steel steam dump system piping components that are exposed to steam because this is identical to GALL Report recommendations in GALL AMP VIII.B1-8 for the same component commodity group/material/environment/aging effect combination and because the staff determined that the applicant's Water Chemistry Program includes program elements and activities that are consistent with the staff's recommendations in GALL AMP XI.M2, "Water Chemistry," and that the program is adequate to manage loss of material due to general corrosion of carbon or low alloy steel piping, piping components, and piping elements in the steam dump system that are exposed to a steam (inside) environment. The staff evaluated the Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.1.

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).

3.4.2.3.5 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Auxiliary Boiler/Steam 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 auxiliary boiler/steam system component groups.

In Table 3.4.2-5, the applicant annotated Note H for its AMR on loss of material due to general corrosion in carbon or low alloy steel piping, piping components, and piping elements in the auxiliary boiler/steam system under exposure to a steam (inside) environment because the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant credited the Water Chemistry Program to manage loss of material due to general corrosion in these components.

The staff concludes that it is acceptable for the applicant to credit the Water Chemistry Program to manage loss of material due to general corrosion in the steel auxiliary boiler/steam system piping components that are exposed to steam because this is identical to GALL Report recommendations in GALL AMP VIII.B1-8 for the same component commodity group/material/environment/aging effect combination and because the staff determined that the applicant's Water Chemistry Program includes program elements and activities that are consistent with the staff's recommendations in GALL AMP XI.M2, "Water Chemistry," and that the program is adequate to manage loss of material due to general corrosion of carbon or low alloy steel piping, piping components, and piping elements in the auxiliary boiler/steam system that are exposed to a steam (inside) environment. The staff evaluated the Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.1.

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).

3.4.2.3.6 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Feedwater 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 feedwater system component groups.

In Table 3.4.2-6, the applicant annotated Note F for its AMR on cracking and changes in material properties for elastomeric piping components, and piping elements in the feedwater system under exposure to an air - indoor (outside) environment because the material is not in the GALL Report for this component, material, and environment combination. The applicant credited the External Surfaces Monitoring Program to manage the aging effects cracking and change in material properties due to various degradation mechanisms.

The staff's review of LRA Section3.4.2.3.6 identified areas in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.4-2, Parts A and B, dated January 7, 2008, the staff informed the applicant that the External Surfaces Monitoring Program may not be an acceptable program to manage cracking and changes in material properties of elastomeric components that are exposed to an air - indoor (outside) environment.

In RAI 3.4-2, Part A, the staff asked the applicant to clarify which material properties would be impacted by the exposure of the elastomeric feedwater system piping, piping components, and piping elements to an air - indoor (outside) environment.

In RAI 3.4-2, Part B, the staff asked the applicant to justify why it considers the External Surfaces Monitoring Program to be capable of managing both cracking and changes in the materials properties of those elastomeric piping, piping components, and piping elements in the feedwater system that are exposed to an air - indoor (outside) environment.

The applicant responded to RAI 3.4-2, Parts A and B, in a letter dated January 17, 2008. The staff's evaluation in SER Section 3.4.2.3.3 of the applicant's response to RAI 3.4-2, Parts A and B, as relevant to the management of material properties and cracking in main steam system elastomeric piping components/elements that are exposed to an air - indoor (outside) environment, is also applicable to the staff's assessment on aging management activities for feedwater system elastomeric piping components/elements that are exposed to an air - indoor (outside) environment. Thus, the staff's resolution of RAI 3.4-2, Part B, in which the staff requested justification for using the External Surfaces Monitoring Program to manage cracking and changes in material properties for these elastomeric feedwater components, is pending. The staff discussed the issue with the applicant on a conference call and it was agreed that these components will be placed in a Preventive Maintenance Program with periodic replacement. The applicant agreed to provide this in a docketed correspondence. This was CI 3.4-1.

In letter dated April 23, 2008, the applicant stated, with the exception of the thermoplastic diaphragm used in the design of the condensate storage tank (CST), the elastomeric and polymeric components identified in RAIs 3.4-2, 3.4-3, 3.4-4, 3.4-5, 3.4-7 and 3.4-8 will be treated as consumables that are evaluated and periodically replaced under the applicant's preventative maintenance program (see Commitment No. 36). As a result of this change, these elastomeric or thermoplastic components will not be required to remain screened in as being within the scope of an aging management review because the components would be periodically replaced and no longer categorized as passive, long-lived components.

Based on this review, the staff finds that the applicant has appropriately addressed the elastomeric and thermoplastic components in the steam and power conversion systems. Confirmatory Item 3.4-1 is closed.

In Table 3.4.2-6, the applicant annotated Note F for its AMR on cracking due to thermal fatigue of nickel base alloys piping components, and piping elements in the feedwater system under exposure to a treated water (inside) environment because the material is not in the GALL Report for this component, material, and environment combination. The applicant credited TLAA to manage the aging effect cracking due to thermal fatigue.

In RAI 3.4-6 dated January 7, 2008, the staff informed the applicant that the TLAA on metal fatigue is based on demonstrating that the piping conditions are not conducive to the initiation of a fatigue-induced flaw in the nickel alloy piping components. The staff also informed the applicant that industry experience with PWRs has demonstrated that cracking from stress corrosion is an applicable aging effect for PWR nickel alloy components. The staff asked the applicant to clarify whether a crack could initiate in these nickel alloy as a result of stress corrosion cracking (including primary water stress corrosion cracking) and whether fatigue induced cracking is already postulated as having initiated in these nickel alloy feedwater system piping components; and if so, why it was valid to credit the TLAA on thermal fatigue, as discussed in LRA Section 4.3, to manage fatigue-induced flaw growth of a crack that initiated by stress corrosion or of an already existing fatigue-induced crack in the piping.

In its response dated January 17, 2008, the applicant stated that the HNP methodology did not predict cracking either by fatigue-induced cracking or by SCC for the nickel based alloys piping component in the feedwater system and that the environmental conditions in this section of the piping are below the threshold for which HNP would predict this aging effect or mechanism. The applicant clarified that, as result of its determination, there is no need to justify using a TLAA for management of fatigue-induced flaw growth of an SCC-initiated crack, because the condition is not applicable to the nickel alloy components in the feedwater system that are exposed to the secondary treated water environment (*i.e.,* to feedwater). The HNP feedwater system is a secondary steam and power conversion system that operates at a temperature less than 500°F.

Based on its review, the staff finds the applicant's response to RAI 3.4-6 acceptable. The staff concludes that SCC initiation will not be an issue for the nickel-alloy piping in the feedwater system because the system operates at a temperature lower than the threshold temperature for initiating SCC in these materials. The staff's concern described in RAI 3.4-6 is resolved.

In Table 3.4.2-6, the applicant annotated Note J for its AMR on elastomeric piping, piping components, and piping elements in the feedwater system under exposure to an air/gas (dry) (inside) environment because the applicant determined that the GALL Report does not include this component commodity group, material, and environment combination is evaluated in the GALL Report. The applicant did not identify any applicable aging effects and did not credit any AMPs for management of these elastomeric piping, piping components, and piping elements.

The staff asked the applicant to provide its basis for identifying that there are not any applicable aging effects requiring management for these elastomeric feedwater system components under exposure to an air/gas (dry) (inside) environment.

In a letter dated August 20, 2008, the applicant stated that the component subject to the AMR is a rubber instrument air hose whose internal surfaces are in contact with dry air. The applicant clarified that, in accordance with the guidance document NEI 95-10, Revision 6, Appendix F, Section 5.2.2.1, internal surfaces of components subject to dry instrument air should not be subject to aging effects/mechanisms.

The staff noted that GALL Report, Volume 2, Table IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing AGING MECHANISMS," identifies that the following "elastomer degradation" aging effects may be applicable to thermoplastic materials, including rubbers: (1) cracking, (2) crazing, (3) fatigue breakdown, (4) abrasion, (5) chemical attacks, (6) weathering, and (&) elastomeric hardening.

In RAI 3.4-7 dated January 7, 2008, the staff asked the applicant to justify why these aging effects are not considered to be applicable aging effects requiring management (AERMs) for the elastomeric feedwater system components that are exposed to an air/gas (dry) (inside) environment and to justify why at least a One-Time Inspection Program is not credited for these elastomeric feedwater piping components.

In its response dated January 17, 2008, the applicant clarified that RAI 3.4-7 is applicable to the instrument air hoses in the turbine building and the HNP review did conclude that aging effects are applicable for the elastomeric feedwater piping component surfaces that are exposed to a dry air/gas environment. The applicant clarified that cracking and changes in material properties are the applicable aging effect requiring management for the elastomeric surfaces that are exposed to a dry air/gas environment, and that these aging effects are applicable because the temperature of dry air/gas environment will be greater than 95°F. The applicant credited the External Surfaces Monitoring Program to manage cracking and changes in material properties in the elastomeric surfaces that are exposed to this dry air/gas environment. The staff's resolution of RAI 3.4-7 was pending. The staff discussed the issue with the applicant on a conference call and it was agreed that these components will be placed in a Preventive Maintenance Program with periodic replacement. The applicant agreed to provide this in a docketed correspondence. This was CI 3.4-1.

In letter dated April 23, 2008, the applicant stated, with the exception of the thermoplastic diaphragm used in the design of the condensate storage tank (CST), the elastomeric and polymetric components identified in RAIs 3.4-2, 3.4-3, 3.4-4, 3.4-5, 3.4-7 and 3.4-8 will be treated as consumables that are evaluated and periodically replaced under the applicant's preventative maintenance program (see Commitment No. 36). As a result of this change, these elastomeric or thermoplastic components will not be within the scope of an aging management review because the components would be periodically replaced and no longer categorized as passive, long-lived components.

Based on this review, the staff finds that the applicant has appropriately addressed the elastomeric and thermoplastic components and CST diaphram in the steam and power conversion systems. Confirmatory Item 3.4-1 is closed.

On the basis of its review, and resolution of CI 3.4-1, as made relevant to the management of aging in feedwater system hoses that are exposed to an air - indoor (outside) environment and the instrument air hoses that are exposed to a dry air/gas environment, 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 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Auxiliary Feedwater 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 auxiliary feedwater system component groups.

In Table 3.4.2-7, the applicant annotated Note H for its AMR on loss of material due to general corrosion in the steel (*i.e.*, carbon steel or low alloy steel) auxiliary feedwater pump turbine under exposure to a steam (inside) environment because the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant credited the Water Chemistry Program to manage loss of material due to general corrosion in the surfaces of the auxiliary feedwater pump turbine that are exposed to a steam (inside) environment.

The staff concludes that it is acceptable for the applicant to credit the Water Chemistry Program to manage loss of material due to general corrosion in the steel auxiliary feedwater pump turbine because this is identical to the AMP recommended in GALL AMP VIII.B1-8 to manage loss of material for similar component/material/environment combinations and because the staff determined that the applicant's Water Chemistry Program includes program elements and activities that are consistent with the staff's recommendations in GALL AMP XI.M2, "Water Chemistry," and which demonstrate that the program is adequate to manage loss of material due to general corrosion of carbon or low alloy steel piping, piping components, and piping elements in the auxiliary boiler/steam system that are exposed to a steam (inside) environment.

As such, the staff concludes that it is acceptable for the applicant to credit for Water Chemistry Program to manage loss of material due to general corrosion in the steel auxiliary feedwater pump turbine under exposure to a steam (inside) environment because the AMP credited is consistent with the AMP recommended for aging management in GALL AMP VIII.B1-8. On this basis, the staff finds the AMPs credited for this AMR item acceptable. The staff evaluated the Water Chemistry Program and its evaluation is documented in sections 3.0.3.1.1.

In Table 3.4.2-7, the applicant annotated Note H for its AMR on cracking due to stress corrosion cracking in the stainless steel auxiliary feedwater pump turbine lube oil cooler components under exposure to the lubricating oil (inside) environment because the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant credited Lubricating Oil Analysis and One-Time Inspection Program to manage cracking due to stress corrosion cracking in these auxiliary feedwater system heat exchanger components (i.e, in the auxiliary feedwater pump turbine lube oil cooler components).

The staff reviewed the Lubricating Oil Analysis Program, which maintains oil system contaminants primarily water and particulate within acceptable limits. The staff determined that the Lubricating Oil Analysis Program is applicable to HNP components that are exposed to either lubricating oil or hydraulic fluid and that the program is designed to prevent or mitigate the effects of corrosion, including loss of material due to pitting and crevice corrosion, thus minimizing the occurrences of aging effects and maintaining the components' ability to perform their intended functions. The staff verified that the applicant's One-Time Inspection Program is credited to verify the effectiveness of the Lubricating Oil Analysis Program and to confirm that loss of material due general, pitting or crevice corrosion is not an applicable aging effect for the surfaces of components that are exposed to lubricating oil or hydraulic fluid. The staff also verified that the scope of the One-Time Inspection Program does include one-time examinations of the metallic piping components that are exposed to lubricating oil or hydraulic fluid.

The staff concludes that it is acceptable for the applicant to credit the Lube Oil Analysis Program and the One-Time Inspection Program to manage cracking due to stress corrosion cracking. The stainless steel auxiliary feedwater pump turbine lube oil cooler components exposed to a lubricating oil environment credits the Water Chemistry Program and has been determined to be consistent with the recommended program elements in GALL AMP XI.M39, "Lubricating Oil Analysis Program," and capable of mitigating the effects of corrosion, including cracking due to stress corrosion cracking, in metallic components that are exposed to lubricating oil environment. The One-Inspection Program has been determined to be consistent with the program elements in GALL AMP XI.M32, "One-Time Inspection," and capable verifying the effectiveness of the Lubricating Oil Analysis Program to mitigate the effects of corrosion, including stress corrosion cracking, in metallic components that are exposed to a lubricating oil environment. The staff evaluated the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.2.18 and 3.0.3.1.5, respectively.

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 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Auxiliary Steam Condensate 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 auxiliary steam condensate system component groups.

The results of these evaluations are all consistent with 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).

3.4.2.3.9 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Condensate 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 condensate system component groups.

The results of these evaluations are all consistent with 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).

3.4.2.3.10 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Condensate 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 condensate storage system component groups.

In Table 3.4.2-10, the applicant annotated Note F for its AMRs on exposure of thermoplastic components in the condensate storage tank to a treated water (inside) environment and to a air/gas (wetted) (outside) environment because the scope of the AMRs for tank components in Table VIII.E of the GALL Report, Volume 2, do cover this tank material. The applicant identified that there are not any applicable aging effects for the thermoplastic components in the condensate storage tank, and as a result, did not credit any AMPs for aging management of these thermoplastic components.

The staff noted that GALL Report, Revision 1, Volume 2, Table IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing AGING MECHANISMS," identifies that thermoplastic materials may be subject to thermal degradation and/or thermoxidative degradation aging effects/mechanisms, including: (1) increased tensile strengths/hardening due to crosslinking, (2) loss of flexibility, (3) chain depolymeration, (4) crystallization, (5) decomposition/chemical reaction.

The staff's review of LRA Section3.4.2.3.10 identified an area in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.4-8 dated January 7, 2008, the staff asked the applicant to justify why these aging effects are not considered to be applicable aging effects requiring management (AERMs) for the thermoplastic condensate storage tank components that are exposed to the treated water (inside) and air/gas (wetted) (outside) environments and to justify why a One-Time Inspection Program has not been credited for these components.

In its response dated January 17, 2008, the applicant clarified that the issue raised in RAI 3.4-8 pertains to the exposure of a thermoplastic diaphragm in the condensate storage tank and to thermoplastic piping components in the secondary sampling system that are exposed internal to a treated water environment on one surface and externally to an air/gas wetted environment. The applicant clarified that these components are located indoors and that the treated water and wetted air/gas environments for these components are at ambient conditions. Based on this information, the applicant concluded that there would not be any aging effects requiring management (AERMs) for the exposure of these thermoplastic components to these environments during the period of extended operation.

GALL Report, Revision 1, Volume 2, Table IX.D, "Selected Definitions & Use of Terms for Describing and Standardizing, ENVIRONMENTS," states that if the ambient temperature "is less than 95°F, then any resultant thermal aging of organic materials can be considered to be insignificant, over the 60-yr period of interest." The staff noted that the applicant's response did not confirm whether the ambient conditions for these treated water and wetted air/gas environments would be less than 35°C (95°F) and thus did not tie down specifically whether or not changes in material properties (including thermal aging of strength and fracture toughness properties) and cracking would be mitigated or precluded by the specific ambient conditions for these environments. This was RAI 3.4-8. The staff discussed the issue with the applicant on a conference call and it was agreed that these components will be placed in a Preventive Maintenance Program with periodic replacement, except the CST diaphragm. The CST diaphragm will have periodic inspections and will be added to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant agreed to provide this in a docketed correspondence. This was CI 3.4-1.

In letter dated April 23, 2008, the applicant stated, with the exception of the thermoplastic diaphragm used in the design of the condensate storage tank (CST), the elastomeric and polymeric components identified in RAIs 3.4-2, 3.4-3, 3.4-4, 3.4-5, 3.4-7 and 3.4-8 will be treated as consumables that are evaluated and periodically replaced under the applicant's preventative maintenance program (see Commitment No. 36). As a result of this change, these elastomeric or thermoplastic components will not be required to remain screened in as being within the scope of an aging management review because the components would be periodically replaced and no longer categorized as passive, long-lived components.

Based on this review, the staff finds that the applicant has appropriately addressed the elastomeric and thermoplastic components in the steam and power conversion systems. Confirmatory Item 3.4-1 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).

3.4.2.3.11 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Secondary Sampling System – LRA Table 3.4.2-11

The staff reviewed LRA Table 3.4.2-11, which summarizes the results of AMR evaluations for the secondary sampling system component groups.

In Table 3.4.2-11, the applicant annotated Note F for its AMRs on exposure of thermoplastic piping, piping components, and piping elements in the secondary sampling system under exposure to treated water (inside), air/gas (wetted) (outside), and radiation (ultraviolet) (outside) environments in the secondary sampling system because the material is not in the GALL Report for this component, material, and environment combination. The applicant did not credit any AMPs for exposure of thermoplastic secondary sampling system piping, piping components, and piping elements to either the treated water (inside) and air/gas (wetted) (outside) environments because the applicant's AMR process did not identify applicable aging effects for these material/environment combinations. For the exposure of the thermoplastic piping, piping components and piping elements to the radiation (ultraviolet) (outside) environment, the applicant identified changes in material properties and cracking due to various degradation mechanisms are applicable aging effects requiring management and credited the External Surfaces Monitoring Program to manage the aging effects.

The staff noted that GALL Report, Volume 2, Table IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing AGING MECHANISMS," identifies that thermoplastic materials may be subject to thermal degradation and/or thermo-oxidative degradation aging effects/mechanisms, including: (1) increased tensile strengths/hardening due to crosslinking, (2) loss of flexibility, (3) chain depolymeration, (4) crystallization, (5) decomposition/chemical reaction.

The staff's review of LRA Section3.4.2.3.11 identified areas in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAIs as discussed below.

In RAI 3.4-8, the staff asked the applicant to justify why these aging effects are not considered to be applicable aging effects requiring management (AERMs) for the thermoplastic components in the secondary sampling system that are exposed to either the treated water (inside) environment or the air/gas (wetted) (outside) environment and to justify why a One-Time Inspection Program has not been credited for these components.

The applicant responded to RAI 3.4-8 by letter dated January 17, 2008. The staff's evaluation of the applicant's response to RAI 3.4-8 has been given in SER Section 3.4.2.3.10.

In RAI 3.4-3 dated January 7, 2008, the staff informed the applicant that the External Surfaces Monitoring Program may not be an acceptable program to manage cracking and changes in material properties of thermoplastic (including polyvinyl chloride [PVC]) components that are exposed to a radiation (ultraviolet, outside) environment. The staff, in part, asked the applicant to justify why it considers the External Surfaces Monitoring Program to be capable of managing both cracking and changes in the materials properties of those thermoplastic piping, piping components, and piping elements in the secondary sampling system that are exposed to the radiation (ultraviolet, outside) environment.

The applicant responded to RAI 3.4-3, and its subparts, by letter dated January 17, 2008. The staff's evaluation of the applicant's response to RAI 3.4-3 has been given in SER Section 3.4.2.3.3.

On the basis of its review, and with resolution of CI 3.4-1, 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).

3.4.2.3.12 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Steam Generator Wet Lay Up System – LRA Table 3.4.2-12

The staff reviewed LRA Table 3.4.2-12, which summarizes the results of AMR evaluations for the steam generator wet lay up system component groups.

In Table 3.4.2-12, the applicant annotated Note J for its AMR on loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements in the steam generator wet lay-up system under exposure to a treated water (inside) environment because neither the component nor the material and environment combination are evaluated in the GALL Report. The applicant credited the One-Time Inspection Program to manage loss of material due to crevice and pitting corrosion and cracking due to stress corrosion cracking in these stainless steel components.

The staff asked the applicant to justify the use of One-Time Inspection Program to manage the aging effect of loss of material due to crevice and pitting corrosion and cracking due to stress corrosion cracking. The applicant stated that this item represents piping, piping components, and piping elements that are water filled but no longer in service. The applicant clarified that the water source is from treated water, and that as such, aging is not expected to occur, but the data is insufficient to rule it out with reasonable confidence. The staff informed the applicant that One-Time Inspection Program is not used to manage an aging effect but includes measures to verify the effectiveness of another AMP and confirm the insignificance of an aging effect. The applicant agreed to amend the LRA and credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the loss of material due to crevice and pitting corrosion and cracking due to stress corrosion cracking in the stainless steel piping, piping components, and piping elements of the steam generator wet lay-up system that are exposed to treated water. The staff concludes that this is acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program proposes periodic visual examinations of the internal surfaces to monitor for evidence of corrosion (including corrosion mechanisms that could induce loss of material or cracking) and because the AMP credits more frequent inspections that would be performed using the One-Time Inspection Program if the analogous AMRs and AMPs in GALL AMRs VIII.B1-4 and VIII.B1-5 for stainless steel main steam system piping, piping components, and piping elements were credited for aging management.

The staff verified that the applicant made the applicable amendment to the LRA by letter dated August 20, 2007. The staff finds that this program includes activities that are consistent with recommendations in the GALL Report, AMP XI.M38, and are adequate to manage loss of material due to general, pitting, and crevice corrosion and cracking due to stress corrosion cracking in stainless steel piping, piping components, and piping elements of steam and power conversion systems that are exposed to a treated water (inside) environment. The staff evaluated the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.7.

In Table 3.4.2-12, the applicant annotated Note J for its AMR on loss of material due to general, pitting, and crevice corrosion of carbon steel or low alloy steel piping, piping components, and piping elements in the steam generator wet lay-up system under exposure to a treated water (inside) environment because neither the component nor the material and environment combination is evaluated in the GALL Report. The staff reviewed the GALL Report and verified that Section VII of the GALL Report, Volume 2, does not include AMRs for stainless steel piping, piping components, and piping elements in steam generator wet lay-up systems under exposure to a treated water (inside) environment and that accordingly Note J is appropriate for this component, material, and environment combination. The applicant credited the One-Time

Inspection Program to manage loss of material due to crevice, general, and pitting corrosion in these carbon steel and low alloy steel piping, piping components, and piping elements.

The staff asked the applicant to justify the use of One-Time Inspection Program to manage the aging effect of loss of material due to crevice, general, and pitting corrosion. The applicant stated that this item represented piping components that are water filled but no longer in service. The applicant clarified that the water source is from treated water, and that as a result, aging is not expected to occur, but the data is insufficient to rule it out with reasonable confidence.

The staff informed the applicant that the One-Time Inspection Program is not intended to manage an aging effect but includes measures to verify the effectiveness of another AMP. The applicant agreed to amend the LRA and credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the loss of material due to crevice, general, and pitting corrosion in the carbon steel and low-alloy steel piping, piping components, and piping elements of the steam generator wet lay-up system that are exposed to treated water. The staff concludes that this is acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program proposes periodic visual examinations of the internal surfaces monitors for evidence of corrosion (including corrosion mechanisms that could induce loss of material or cracking) and because the AMP credits more frequent inspections that would be performed using the One-Time Inspection Program if the analogous AMR and AMPs in GALL AMR VIII.B1-4 for stainless steel main steam system piping, piping components, and piping elements were credited for aging management. The staff verified that the applicant made the applicable amendment to the LRA by letter dated August 20, 2007. The staff finds that this program includes activities that are consistent with recommendations in the GALL Report, AMP XI.M38, and are adequate to manage loss of material due to crevice, general, and pitting corrosion of carbon steel piping, piping components, and piping elements of steam and power conversion systems that are exposed to a treated water (inside) environment. The staff evaluated the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.7.

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).

3.4.2.3.13 Steam and Power Conversion Systems - Summary of Aging Management Evaluation - Turbine System – LRA Table 3.4.2-13

The staff reviewed LRA Table 3.4.2-13, which summarizes the results of AMR evaluations for the turbine system component groups. The results of these evaluations are all consistent with 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).

3.4.3 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, component supports components and component groups of:

- containment structure
- containment internal structures
- reactor auxiliary building
- auxiliary reservoir channel
- auxiliary dam and spillway
- auxiliary reservoir
- auxiliary reservoir separating dike
- cooling tower
- cooling tower makeup water intake channel
- circulating water intake structure
- diesel generator building
- main dam and spillway
- diesel fuel oil storage tank building
- emergency service water and cooling tower makeup intake structure
- emergency service water discharge channel
- emergency service water discharge structure
- emergency service water intake channel
- fuel handling building
- HVAC equipment room
- outside the power block structures
- main reservoir
- security building
- emergency service water screening structure
- normal service water intake structure

- switchyard relay building
- transformer and switchyard structures
- turbine building
- tank area/building
- waste processing building
- yard structures

3.5.1 Summary of Technical Information in the Application

LRA Section 3.5 provides AMR results for the containments, structures, component supports components and component groups. LRA Table 3.5.1, "Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containments, Structures, and Component Supports," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the containments, structures, component supports components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience 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 operating experience included a review of the GALL Report and operating experience 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, component 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 verify 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.

During 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 and 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 operating experience 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 Supports 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
PWR Concrete (Reinforced and Prestressed) and Steel 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	ASME Section XI, Subsection IWL Program (B.2.27)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
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	Structures Monitoring Program (B.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)

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
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 (See SER Section 3.5.2.2.1)
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 (See SER Section 3.5.2.2.1)
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	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.2.1)

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 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	ASME Section XI Subsection IWE Program (B.2.26); 10 CFR Part 50, Appendix J Program (B.2.29)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
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 (See SER Section 3.5.2.2.1)
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	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.2.1)
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	Fatigue is a TLAA (See SER Section 3.5.2.2.1)
Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds (3.5.1-10)	Cracking due to stress corrosion cracking	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 (See SER Section 3.5.2.2.1)

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
Stainless steel vent line bellows, (3.5.1-11)	Cracking due to stress corrosion cracking	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 PWRs (See SER Section 3.5.2.2.1)
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	ASME Section XI Subsection IWE Program (B.2.26); 10 CFR Part 50, Appendix J Program (B.2.29)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
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 to PWRs (See SER Section 3.5.2.2.1)
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	ASME Section XI, Subsection IWL Program (B.2.27)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
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	ASME Section XI, Subsection IWL Program (B.2.27)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)

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
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	ASME Section XI Subsection IWE Program (B.2.26); 10 CFR Part 50, Appendix J Program (B.2.29)	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	10 CFR Part 50, Appendix J Program (B.2.29); Plant Technical Specifications	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	ASME Section XI Subsection IWE Program (B.2.26); 10 CFR Part 50, Appendix J Program (B.2.29)	Consistent with GALL Report (See SER Section 3.5.2.1)
Steel elements: stainless steel suppression chamber shell (inner surface) (3.5.1-19)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable	Not applicable to PWRs
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	Not applicable	Not applicable to PWRs
Steel elements: drywell head and downcomer pipes (3.5.1-21)	Fretting or lock up due to mechanical wear	ISI (IWE)	No	Not applicable	Not applicable to PWRs

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
Prestressed containment: tendons and anchorage components (3.5.1-22)	Loss of material due to corrosion	ISI (IWL)	No	Not applicable	Not applicable (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.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)

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
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.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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.2.31); RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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	Not applicable	Not applicable (See SER Section 3.5.2.2.2)
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	Structures Monitoring Program (B.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)

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
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.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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 (See SER Section 3.5.2.2.2)

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
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	RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32); Structures Monitoring Program (B.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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	RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32); Structures Monitoring Program (B.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)

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
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	RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32); Structures Monitoring Program (B.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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	RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32); Structures Monitoring Program (B.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
Groups 7, 8: tank liners (3.5.1-38)	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes	Not applicable	Not applicable (See SER Section 3.5.2.2.2)
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.2.31)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)

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
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.2.31); RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
Vibration isolation elements (3.5.1-41)	Reduction or loss of isolation function, radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Yes	Not applicable	Not applicable (See SER Section 3.5.2.2.2)
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	Not applicable	Not applicable (See SER Section 3.5.2.2.2)
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 Program (B.2.30); Fire Protection Program (B.2.14)	Consistent with GALL Report (See SER Section 3.5.2.1.11)
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.2.31)	Consistent with GALL Report (See SER Section 3.5.2.1.12)

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 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	RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32); Structures Monitoring Program (B.2.31)	Consistent with GALL Report (See SER Section 3.5.2.1.13)
Group 5: fuel pool liners (3.5.1-46)	Cracking due to stress corrosion cracking; 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	Water Chemistry Program (B.2.2); Monitoring Cavity Level with Technical Specifications, Monitoring Leakage from Leak Chase Channel	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	RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32); Structures Monitoring Program (B.2.31)	Consistent with GALL Report (See SER Section 3.5.2.14)
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	RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program (B.2.32)	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	Not applicable	Not applicable to PWRs
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.2.31)	Consistent with GALL Report (See SER Section 3.5.2.1)
Group B1.1: high strength low-alloy bolts (3.5.1-51)	Cracking due to stress corrosion cracking; loss of material due to general corrosion	Bolting Integrity	No	Not applicable	Not applicable (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 (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	ASME Section XI, Subsection IWF Program (B.2.28)	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	ASME Section XI, Subsection IWF Program (B.2.28)	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, 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	Boric Acid Corrosion Program (B.2.4)	Consistent with GALL Report (See SER Section 3.5.2.1.15)
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	ASME Section XI, Subsection IWF Program (B.2.28)	Consistent with GALL Report (See SER Section 3.5.2.1)
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 (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 (See SER Section 3.5.2.1.16)
Stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-59)	None	None	No	None	Consistent with GALL Report (See SER Section 3.5.2.1.17)

The staff's review of the containments, structures, component 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 component supports components are 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, component supports components:

- Water Chemistry Program
- Boric Acid Corrosion Program
- Boraflex Monitoring Program
- Inspection of Overhead Heavy Load and Light Load Handling Systems Program
- Fire Protection Program
- One-Time Inspection Program
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- ASME Section XI, Subsection IWE Program
- ASME Section XI, Subsection IWL Program
- ASME Section XI, Subsection IWF Program
- 10 CFR Part 50, Appendix J Program
- Masonry Wall Program
- Structures Monitoring Program
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program

LRA Tables 3.5.2-1 through 3.5.2-29 summarize AMRs for the containments, structures, and component support 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's evaluation follows.

3.5.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.5.1 shows items 22, 51, 52 and 57 as "Not Applicable" as the component, material, and environment combination is not present. For each of these line items, the staff reviewed the LRA and the applicant's supporting license renewal basis calculations and confirmed the applicant's claim that the component, material, and environment combination is not present. On the basis that HNP has no component, material, and environment combination for these Table 1 line items, the staff finds that they do not apply.

3.5.2.1.2 Cracking Due to Expansion Due to Reaction With Aggregates

During the audit and review, the staff noted that in LRA Table 3.5.2-27 on page 3.5-182 for AMR component concrete roof slab, material reinforced concrete in an air-outdoor environment, aging effects loss of material and cracking, shows LRA Table 1, item 3.5.1-27 and GALL Report, item III.A8-1, which do not address loss of material and cracking as do LRA Table 1, item 3.5.1-26 and GALL Report, item III.A8-5. The staff asked the applicant to explain why GALL Report, item III.A8-1 and LRA Table 1, item 3.5.1-27 are with the aging effects for this AMR line item.

In its letter dated August 20, 2007, the applicant stated that in LRA Table 3.5.2-27 on page 3.5-182 for AMR component concrete roof slab, material reinforced concrete in an air-outdoor environment, the first row should be revised as follows:

> Loss of Material, Cracking - Structures Monitoring Program - III.A8-5, (T-01) - 3.5.1-26 - Note A

On the basis of this response, the first row of LRA Table 3.5.2-27, page 3.5-182, for AMR component concrete roof slab, material reinforced concrete in an air-outdoor environment, will be changed or revised as follows.

> Loss of Material, Cracking - Structures Monitoring Program - III.A8-5, (T-01) - 3.5.1-26 - Note A

In the same August 20, 2007 letter, the applicant amended LRA Table 3.5.2-27 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

During the audit and review, the staff noted that in LRA Table 3.5.2-27 on page 3.5-182 for AMR component concrete roof slab, material reinforced concrete in an air-outdoor environment, aging effect cracking, shows LRA Table 1, item 3.5.1-27 and GALL Report, item III.A8-5, which does not address cracking alone as does GALL Report, item III.A8-1. The staff asked the applicant to explain why GALL Report, item III.A8-5 is with the aging effect for this AMR line item.

In its letter dated August 20, 2007, the applicant stated that LRA Table 3.5.2-27, page 3.5-182, for AMR component concrete roof slab, material reinforced concrete in an air-outdoor environment, the second row should be revised as follows:

Cracking - Structures Monitoring Program - III.A8-1 (T-03) - 3.5.1-27 - Note A, 504

On the basis of this response, the second row of LRA Table 3.5.2-27, page 3.5-182, for AMR component concrete roof slab, material reinforced concrete in an air-outdoor environment will be changed or revised as follows.

Cracking - Structures Monitoring Program - III.A8-1 (T-03) - 3.5.1-27 - Note A, 504

In the same August 20, 2007 letter, the applicant amended LRA Table 3.5.2-27 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.3 Cracks and Distortion due to Increased Stress Levels From Settlement

For cracks and distortion due to increased stress levels from settlement of reinforced concrete for structural groups 1-3 and 5-9 concrete components exposed to soil, the GALL Report recommends programs consistent with GALL AMP XI.S6, "Structures Monitoring Program."

However, the applicant manages cracking due to increased stress levels from settlement of the reinforced concrete Group 6 auxiliary dam and spillway and main dam and spillway component concrete: exterior below grade exposed to soil environments with the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program (with enhancements).

The staff's evaluation of the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program is documented in SER Section 3.0.3.2.25. This program inspects concrete dams for structural cracking from overstress due to applied loads, shrinkage and temperature effects, differential movements (*e.g.*, settlement), and for evidence of abnormal settlements, heaving, deflections, or lateral movements.

Because the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program requirements for inspection and detection of cracking due to increased stress levels from settlement are essentially the same as those for such inspections by the applicant's Structures Monitoring Program, the staff finds the AMP acceptable for cracking of the auxiliary dam and spillway and main dam and spillway components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

During the audit and review, the staff noted that LRA Tables 3.5.2-10, 3.5.2-17, 3.5.2-26 and 3.5.2-27 on pages 3.5-102, 3.5-131, 3.5-173 and 3.5-181, respectively, for AMR components concrete exterior below grade or concrete foundation, material reinforced concrete in a soil environment, aging effect cracking, refer to LRA Table 1, item 3.5.1-28, Note 537, which states, "HNP has no porous concrete subfoundation and does not implement a de-watering system; therefore this aging effect is not present and no aging management is required." The staff asked the applicant to explain Note 537 for these line items with LRA Table 1, item 3.5.1-28, which addresses cracks and distortion due to increased stress levels from settlement.

In its letter dated August 20, 2007, the applicant stated that Note 537 is incorrect with concrete exterior below grade, material reinforced concrete in a soil environment in LRA Table 3.5.2-10 on page 3.5-102.

On the basis of this response, the LRA will be amended to remove Note 537 from concrete exterior below grade, material reinforced concrete in a soil environment in LRA Table 3.5.2-10 on page 3.5-102. Note 537 is also incorrect with concrete exterior below grade, material reinforced concrete in a soil environment in LRA Tables 3.5.2-17 on page 3.5-131 and 3.5.2-26 on page 3.5-173. On the basis of this response, the LRA was amended also to remove Note 537 from concrete exterior below grade, material reinforced concrete in a soil environment in LRA Tables 3.5.2-17 on page 3.5-131, and 3.5.2-26 on page 3.5-173. Note 537 is also incorrect with concrete foundation, material reinforced concrete in a soil environment [Table 1, item 3.5.1-28, III.A8-2 (T-08)] in LRA Table 3.5.2-27 on page 3.5-181. On the basis of this response, the LRA will be amended to remove Note 537 from concrete foundation, material reinforced concrete in a soil environment [Table 1, item 3.5.1-28, III.A8-2 (T-08)] in LRA Table 3.5.2-27 on page 3.5-181.

In the same August 20, 2007 letter, the applicant amended LRA Tables 3.5.2-10, 3.5.2-17, 3.5.2-26, and 3.5.2-27 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

During the audit and review, the staff noted that in LRA Table 3.5.2-21 on page 3.5-148 for AMR component concrete: exterior below grade, aging effect cracking, and LRA Table 1, item 3.5.1-28 there is only Note A. All other Table 2 AMR line items referring to LRA Table 1, item 3.5.1-28 also have Note 530. The staff asked the applicant to explain why Note 530 is not in this Table 2 AMR line item or in LRA Table 3.5.2-21 on page 3.5-149 for the AMR component concrete: foundation.

In its letter dated August 20, 2007, the applicant stated that the AMR license renewal basis calculation applies Note 530 to AMR line items to address aging effects for concrete due to settlement; however, the license renewal basis calculation did not apply Note 530 to two nonsafety-related structures, the Security Building (LRA Table 3.5.2-21) and the Switchyard Relay Building (LRA Table 3.5.2-24); therefore, Note 530 should be included for the Security Building (LRA Table 1, item 3.5.1-28 on LRA Table 3.5.2-21) for AMR component concrete: exterior below grade (LRA page 3.5.1-148), for AMR component concrete: foundation (LRA page 3.5-149), and for the Switchyard Relay Building (LRA Table 1, item 3.5.1-28 on Table 3.5.2-24) for AMR component concrete: foundation (LRA page 3.5-164).

On the basis of this response, the LRA and the license renewal basis calculation will be amended to include Note 530 at two locations for the Security Building (3.5.1-28 for AMR components concrete: exterior below grade, and AMR component concrete: foundation) and one location for the Switchyard Relay Building (3.5.1-28 for AMR component concrete: foundation).

In the same August 20, 2007 letter, the applicant amended LRA Tables 3.5.2-21 and 3.5.2-24 accordingly.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.4 Increase in Porosity and Permeability, Loss of Strength Due to Leaching of Calcium Hydroxide

During the audit and review, the staff noted that in LRA Table 3.5.2-26 on page 3.5-173 for AMR component concrete: exterior above grade the aging effect cracking is shown with Table 1, item 3.5.1-32. The staff asked the applicant to explain why the aging effect cracking instead of change in material properties is with Table 1, item 3.5.1-32.

In its letter dated August 20, 2007, the applicant stated that LRA Table 1, item 3.5.1-32 in LRA Table 3.5.2-26 on page 3.5-173 should be removed because the Turbine Building has no exterior above grade concrete in a flowing-water environment evaluated in GALL Report item III.A3-7. This change will be consistent with other Group 3 structures (see LRA Table 3.5.2-2 and LRA Table 3.5.2-10 as examples for where concrete: exterior above grade is not evaluated in GALL Report, item III.A3-7.)

On the basis of this response, the LRA and the license renewal basis calculation will be amended to delete the line in LRA Table 3.5.2-26 on page 3.5-173 for Table 1, item 3.5.1-32 for AMR component concrete: exterior above grade.

In the same August 20, 2007 letter, the applicant amended LRA Table 3.5.2-26 to delete the AMR line item accordingly.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.5 Cracking, Loss of Bond, Loss of Material Due to Corrosion of Embedded Steel; Increase in Porosity and Permeability, Cracking, Loss of Material Due to Aggressive Chemical Attack

For increased porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack of reinforced concrete for structural Group 6 concrete components exposed to ground water or soil, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages loss of material, cracking, and change in material properties due to aggressive chemical attack of the reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components concrete: exterior below grade and concrete foundation exposed to soil environments with the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program (with enhancements) and the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. This program inspects reinforced concrete components in structures for loss of material, cracking, and change in material properties due to aggressive chemical attack.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of loss of material, cracking, and change in material properties due to aggressive chemical attack are essentially the same as those of the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds either or both an acceptable AMP for loss of material, cracking, and change in material properties for of the emergency service water and cooling tower makeup intake structures, emergency service water discharge structures, and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

For cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for reinforced concrete structural Group 6 concrete components exposed to uncontrolled air-indoor and air-outdoor, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages cracking, loss of bond, and loss of material due to corrosion of embedded steel of reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure and emergency service water screening structure components concrete: roof slab and concrete: interior exposed to air-indoor or outdoor environments with the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program inspects reinforced concrete components in structures for cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are essentially the same as those of the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds it an acceptable AMP for cracking, loss of bond, and loss of material of the emergency service water and cooling tower makeup intake structures and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

For cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for reinforced concrete structural Group 6 concrete components exposed to uncontrolled air-indoor and air-outdoor, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages cracking, loss of bond, and loss of material due to corrosion of embedded steel of the reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components concrete: exterior above grade exposed to air-outdoor environments using the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program (with enhancements) and the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program inspects reinforced concrete components in structures for cracking, loss of bond, and loss of material due to corrosion of embedded steel.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of cracking, loss of bond, and loss of material properties due to corrosion of embedded steel are essentially the same as those of the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds either or both an acceptable AMP for cracking, loss of bond, and loss of material of the above emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.6 Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw

For loss of material (spalling, scaling) and cracking due to freeze thaw for reinforced concrete structural Group 6 concrete exterior above and below grade; foundation components exposed to air-outdoor, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages loss of material and cracking due to freeze-thaw of the reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure and emergency service water screening structure components concrete: roof slab exposed to an air-outdoor environment using the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program inspects reinforced concrete components in structures for loss of material and cracking due to freeze-thaw.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of loss of material and cracking due to freeze-thaw are essentially the same as those of the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds it an acceptable AMP for loss of material and cracking of the above emergency service water and cooling tower makeup intake structure and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

For loss of material (spalling, scaling) and cracking due to freeze-thaw for reinforced concrete structural Group 6 concrete exterior above and below grade foundation components exposed to air-outdoor, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages loss of material and cracking due to freeze thaw of the reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components concrete: exterior above grade exposed to air-outdoor environments with the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program (with enhancements) and the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program inspects reinforced concrete components in structures for loss of material and cracking due to freeze-thaw.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of loss of material and cracking due to freeze-thaw are essentially the same as those of the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds either or both an acceptable AMP for loss of material and cracking of the emergency service water and cooling tower makeup intake structures, emergency service water discharge structure, and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.7 Cracking Due to Expansion/Reaction With Aggregates

For cracking due to expansion or to reaction with aggregates for reinforced concrete structural Group 6 concrete: all exposed to any environment, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages cracking due to expansion or to reaction with aggregates of the reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure and emergency service water screening structure components concrete: interior, concrete: roof slab exposed to air-indoor and air-outdoor environments, respectively, with the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program inspects reinforced concrete components in structures for cracking due to expansion or to reaction with aggregates.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of cracking due to expansion or to reaction with aggregates are essentially the same as those RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds it an acceptable AMP for cracking of emergency service water and cooling tower makeup intake structure and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

For cracking due to expansion or to reaction with aggregates for reinforced concrete structural Group 6 concrete: all exposed to any environment, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages cracking due to expansion or to reaction with aggregates of the reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components concrete: exterior above grade, concrete: exterior above grade, concrete: exterior below grade, and concrete foundation exposed to air-outdoor, raw water, and soil environments, respectively, with RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program (with enhancements) and the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program inspects reinforced concrete components in structures for cracking due to expansion or to reaction with aggregates.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of cracking due to expansion or to reaction with aggregates are essentially the same as RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds either or both an acceptable AMP for cracking of emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.8 Increase in Porosity and Permeability, Loss of Strength Due to Leaching of Calcium Hydroxide

For increased porosity and permeability and loss of strength due to leaching of calcium hydroxide for reinforced concrete structural Group 6 concrete: exterior above and below grade, foundation, and interior slab exposed to a flowing water environments, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

The applicant manages change in material properties due to leaching of calcium hydroxide of reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components concrete: exterior above grade, concrete: exterior below grade, and concrete foundation exposed to raw water, soil, and soil environments, respectively, with RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program (with enhancements) and the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program inspects reinforced concrete components in structures for change in material properties due to leaching of calcium hydroxide.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of change of material properties due to leaching of calcium hydroxide are essentially the same as RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds either or both an acceptable AMP for change of material properties of emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.9 Loss of Material Due to General and Pitting Corrosion

During the audit and review, the staff noted that LRA Table 3.5.2-29 on page 3.5-197 for AMR component siding includes Notes A and 544. The component siding is different from the components evaluated in the GALL Report, Volume 2, item III.B.5-7, shown for this AMR line item. The staff asked the applicant to explain why Note A (consistent component) versus C (different component) and why Note 544, which addresses non-fire doors, floor drains, and fire hose stations, not siding, is with this AMR line item.

In its letter dated August 20, 2007, the applicant stated that the GALL Report has no category for carbon steel siding; however, the GALL Report, Volume 2, item III.B.5-7 has a miscellaneous structures category with material and environment as for carbon steel siding. HNP included carbon steel siding within this category but omitted details for the component to explain Note 544 as for non-fire doors, floor drains, and fire hose stations. Additionally, standard Note C is more appropriate than Note A for this line item to explain that the component is different from but consistent with the GALL Report item for material, environment, and aging effect.

On the basis of this response, the LRA and the license renewal basis calculation will be amended to change plant-specific Note 544, LRA page 3.5-201, to include siding. Additionally, for the siding line item on LRA page 3.5-197, the standard Note A will be changed to standard Note C.

In the same August 20, 2007 letter, the applicant amended LRA Table 3.5.2-29 and Note 544 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.10 Reduction in Concrete Anchor Capacity Due to Local Concrete Degradation Due to Service-Induced Cracking or Other Concrete Aging Mechanisms

For reduction in concrete anchor capacity due to local concrete degradation due to service-induced cracking or other concrete aging mechanisms for reinforced concrete, grout building concrete at locations of expansion, and grouted anchors and grout pads for support base plates exposed to uncontrolled air-indoor or air-outdoor environments, the GALL Report recommends programs consistent with GALL AMP XI.S6, "Structures Monitoring Program."

However, the applicant manages reduction in concrete anchor capacity due to local concrete degradation of the reinforced concrete Group 6 main dam and spillway components concrete: exterior above grade exposed to air-outdoor environments with the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program (with enhancements).

The staff's evaluation of the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program is documented in SER Section 3.0.3.2.25. This program inspects concrete dams for structural cracking from overstress due to applied loads (*e.g.*, anchor bolts), shrinkage, temperature effects, or differential movements (*e.g.*, settlement).

Because the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program requirements for inspection and detection of reduction in concrete anchor capacity due to local concrete degradation from service-induced cracking or other concrete aging mechanisms are essentially the same as those of the applicant's Structures Monitoring Program, the staff finds it an acceptable AMP for reduction in concrete anchor capacity of main dam and spillway components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.11 Cracking Due to Restraint Shrinkage, Creep, and Aggressive Environment

For cracking due to restraint shrinkage, creep, and aggressive environments for concrete block at all masonry walls exposed to uncontrolled air-indoor or air-outdoor environments, the GALL Report recommends programs consistent with GALL AMP XI.S5, "Masonry Wall Program."

However, the applicant manages cracking due to restraint shrinkage, creep, and aggressive environment of the concrete block reactor auxiliary building and fuel-handling building component masonry walls exposed to air-indoor environments with the Masonry Wall Program (with enhancements) and the Fire Protection Program (with enhancements).

The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.10. The Fire Protection Program inspects masonry walls for cracking due to restraint shrinkage, creep, and aggressive environments.

Because the applicant's Fire Protection Program requirements for inspection and detection of cracking due to restraint shrinkage, creep, and aggressive environment are essentially the same as those of the applicant's Masonry Wall Program, the staff finds either or both an acceptable AMP for cracking of these reactor auxiliary building and fuel -handling building components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.12 Loss of Sealing Due to Deterioration of Seals, Gaskets, and Moisture Barriers (Caulking, Flashing, and Other Sealants)

During the audit and review, the staff noted that in LRA Table 3.5.2-17 on page 3.5-138 for AMR components roof membrane/built-up and seals and gaskets, Note 553 states in its second sentence, "However, these elastomers are in the Group 3 structures rather than a Group 6 structure (III.A6-12)." LRA Table 3.5.2-17 is for the fuel handling building. The staff asked the applicant to explain why the note refers to the GALL Report Group 3 instead of Group 5 structures, fuel storage facility.

In its letter dated August 20, 2007, the applicant stated the license renewal basis calculation dedicated Note 553 for the roof membrane/built-up and seals and gaskets in the fuel handling building, a the GALL Report Group 5 structure. The license renewal basis calculation does not refer to Group 5 structures in Note 553, which was omitted in the LRA; therefore, Note 553 also should refer to the GALL Report Group 5 structures.

On the basis of this response, the LRA and the license renewal basis calculation will be amended to change Note 553 to include the GALL Report Group 5 structures.

In the same August 20, 2007, letter, the applicant amended Note 553 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

During the audit and review, the staff noted that in LRA Table 3.5.2-27 on page 3.5-184 for AMR components roof membrane/built-up and elastomers, Note 553 states in its second sentence: "However, these elastomers are in the Group 3 structures rather than a Group 6 structure (III.A6-12)." LRA Table 3.5.2-27 is for the tank area and building. The staff asked the applicant to explain why the note refers to the GALL Report Group 3 instead of Group 8 structures, steel tanks and missile barriers.

In its letter dated August 20, 2007, the applicant stated the license renewal basis calculation dedicated Note 553 for the roof membrane/built-up and seals and gaskets in the tank area and building and the diesel fuel oil storage tank building. The tank area and building and the diesel fuel oil storage tank building are the GALL Report Group 8 structures. The license renewal basis calculation does not refer to Group 8 structures in Note 553, which was also omitted in the LRA; therefore, Note 553 also should refer to the GALL Report Group 8 structures.

On the basis of this response, the LRA and the license renewal basis calculation will be amended to change Note 553 to refer to the GALL Report Group 8 structures.

In the same August 20, 2007 letter, the applicant amended Note 553 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.13 Loss of Material Due to Abrasion Cavitation

For loss of material due to abrasion cavitation for reinforced concrete structural Group 6 concrete: exterior above and below grade, foundation, interior slab exposed to flowing water environments, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages loss of material due to abrasion cavitation of the reinforced concrete cooling tower, circulating water intake structure, normal service water intake structure, and yard structure components concrete: exterior above grade, concrete: exterior below grade (except normal service water intake structure), and concrete foundation exposed to raw water environments with the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. This program inspects reinforced concrete components in structures for loss of material due to abrasion cavitation.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of loss of material due to abrasion cavitation are essentially the same as those of the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds it an acceptable AMP for loss of material of cooling tower, circulating water intake structure, normal service water intake structure, and yard structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

For loss of material due to abrasion cavitation for reinforced concrete structural Group 6 concrete: exterior above and below grade, foundation, and interior slab exposed to flowing water environments, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

The applicant manages loss of material due to abrasion cavitation of reinforced concrete Group 6 emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components concrete: exterior above grade exposed to raw water environments with the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program (with enhancements) and the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. This program inspects reinforced concrete components in structures for loss of material due to abrasion cavitation.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of loss of material due to abrasion cavitation are essentially the same as those of the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds either or both an acceptable AMP for loss of material of emergency service water and cooling tower makeup intake structure, emergency service water discharge structure, and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.14 Loss of Material Due to General (Steel Only), Pitting and Crevice Corrosion

In response to RAI 2.4-3, by letter dated September 24, 2007, the applicant stated that it would amend LRA section 3.5. The specific changes are:

Revise LRA Table 3.5.2-13 and 3.5.2-22 to add for component/commodity "Platforms, Pipe Whip Restraints, Jet Impingement Shields, Masonry Wall Supports, and Other Miscellaneous Structures (includes support members, welds, bolted connections, support anchorage to building structure)" a new material/environment for carbon steel in a raw water environment as follows:

Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Item	Table 1 Item	Notes
Raw Water	Loss of Material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E, 515, 575

Add new plant-specific Note 575 to read:

575 HNP utilizes the Structures Monitoring Program instead of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program for inspections of the coarse screens in a Raw Water environment.

Add the following after the first sentence in the discussion column of LRA Table 3.5.1, Item 3.5.1-47:

However, HNP uses the Structures Monitoring Program for the coarse screens in raw water at the Emergency Service Water and Cooling Tower Makeup Intake Structure and Emergency Service Water Screening Structure.

See RAI 2.4-3 in this SER for the applicant's direct response to the RAI and the staff's evaluation of the response. The staff's evaluation of the amendment to LRA Section 3.5 due to RAI 2.4-3 follows.

For loss of material due to general (steel only), pitting, and crevice corrosion for steel structural Group 6 platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures (including support members, welds, bolted connections, and support anchorage to building structure) exposed to raw water environments, the GALL Report recommends programs consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program."

However, the applicant manages loss of material due to general (steel only), pitting, and crevice corrosion of the carbon steel emergency service water and cooling tower makeup intake structure and emergency service water screening structure components platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures (including support members, welds, bolted connections, and support anchorage to building structure) exposed to raw water environments with the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program inspects carbon steel components in structures for loss of material due to general (steel only), pitting, and crevice corrosion.

Because the applicant's Structures Monitoring Program requirements for inspection and detection of loss of material due to general (steel only), pitting, and crevice corrosion are essentially the same as those of the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the staff finds it an acceptable AMP for loss of material of emergency service water and cooling tower makeup intake structure and emergency service water screening structure components.

On the basis of its review, the staff finds that the applicant adequately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.15 Loss of Material Due to Boric Acid Corrosion

During the audit and review, the staff noted that in LRA Table 3.5.2-17 on page 3.5-134 for AMR component fire hose stations, material carbon steel in borated water leakage environments, aging effect loss of material, Table 1, item 3.5.1-55, Note 544 refers to the GALL Report item III.B5-7, which has nothing to do with boric acid corrosion. The staff asked the applicant to explain why Note 544, instead of Note 539, refers to the GALL Report item III.B5-8 that addresses boric acid corrosion.

In its letter dated August 20, 2007, the applicant stated Note 539, instead of Note 544, should be in LRA Table 3.5.2-17 on page 3.5-134 for AMR component fire hose stations, material carbon steel in borated water leakage environments, aging effect loss of material.

On the basis of this response, LRA Table 3.5.2-17 on page 3.5-134 for AMR component fire hose stations, material carbon steel in borated water leakage environments, aging effect loss of material will be amended to change Note 544 to Note 539.

In the same August 20, 2007 letter, the applicant amended LRA Table 3.5.2-17 for this AMR line item to change Note 544 to Note 539.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.16 None (Galvanized Steel and Aluminum Support Members; Welds; Bolted Connections; Support Anchorage to Building Structure Exposed to Air Indoor Uncontrolled)

During the audit and review, the staff noted that in LRA Table 3.5.2-2 on page 3.5-83 for AMR component phase bus enclosure assemblies, material aluminum in air-indoor environments, Note 572 states: "The component 'Phase Bus Assemblies' is aligned with III.B2-7 because it has the same material, environment, aging effect, and AMP; although it is not the same the GALL Report component 'Support members; welds, bolted connections, support anchorage to building structure;'" however, this Table 2 AMR line item is aligned with the GALL Report, Volume 2, item III.B3-2. The staff asked the applicant to explain the discrepancy between the GALL Report alignment reference in Note 572 and the GALL Report alignment shown for this Table 2 AMR line item.

In its letter dated August 20, 2007, the applicant stated the license renewal basis calculation has the following text for Note 572:

> The components "Phase Bus Assemblies" are aligned with III.B2-7 or III.B3-2 or III.B3-5 because they have the same material, environment, aging effect and AMP although they are not the same GALL Report component "Support members; welds, bolted connections, support anchorage to building structure."

This Note 572 change inadvertently was not incorporated into the LRA before submission to the NRC. III.B3-2 is correct for the LRA Table 3.5.2-2 AMR line item for phase bus enclosure assemblies, material aluminum in air-indoor environments on page 3.5-83.

The revised Note 572 applies at other LRA locations as well as follows:

> Table 3.5.2-25, page 3.5-169 - GALL Report, Volume 2, item B2-7 is correct for AMR component phase bus enclosure assemblies, material aluminum in an air-outdoor environment.

On the basis of this response, the LRA will be amended to revise Note 572 to agree with the license renewal basis calculation.

In the same August 20, 2007 letter, the applicant amended Note 572 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

During the audit and review, the staff noted that in LRA Table 3.5.2-26 on page 3.5-177 for AMR component phase bus enclosure assemblies, material aluminum in air-indoor environments, aging effect none, Table 1, item 3.5.1-58, Note 572 refers to the GALL Report item III.B2-7. The staff asked the applicant why the GALL Report item III.B2-7 is in the note as the GALL Report item III.B3-2 is shown for this Table 2 AMR line item and Table 1, item 3.5.1-58 does not refer to the GALL Report item III.B2-7.

In its letter dated August 20, 2007, the applicant stated the license renewal basis calculation has the following text for Note 572:

The components "Phase Bus Assemblies" are aligned with III.B2-7 or III.B3-2 or III.B3-5 because they have the same material, environment, aging effect and AMP although they are not the same GALL Report component "Support members; welds, bolted connections, support anchorage to building structure."

This Note 572 change inadvertently was not incorporated into the LRA before submission to the NRC. LRA Table 3.5.2-26, page 3.5-177, the GALL Report, Volume 2, item B3-2, is correct for AMR component phase bus enclosure assemblies, material aluminum in air-indoor environments.

On the basis of this response, the LRA will be amended to revise Note 572 to agree with the license renewal basis calculation.

In the same August 20, 2007 letter, the applicant amended Note 572 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

3.5.2.1.17 None (Stainless Steel Support Members; Welds; Bolted Connections; Support Anchorage to Building Structure)

During the audit and review, the staff noted that in LRA Table 3.5.2-2 on page 3.5-83 for AMR component phase bus enclosure assemblies, material stainless steel in an air-indoor environment, Note 572 states: "The component 'Phase Bus Assemblies' is aligned with III.B2-7 because it has the same material, environment, aging effect, and AMP; although it is not the same the GALL Report component 'Support members; welds, bolted connections, support anchorage to building structure;'" however, this Table 2 AMR line item is aligned with the GALL Report, Volume 2, item III.B3-5. The staff asked the applicant to explain the discrepancy between the GALL Report alignment in Note 572 and the GALL Report alignment shown for this Table 2 AMR line item.

In its letter dated August 20, 2007, the applicant stated that the license renewal basis calculation has the following text for Note 572:

The components "Phase Bus Assemblies" are aligned with III.B2-7 or III.B3-2 or III.B3-5 because they have the same material, environment, aging effect and AMP although they are not the same GALL Report component "Support members; welds, bolted connections, support anchorage to building structure."

This Note 572 change inadvertently was not incorporated into the LRA before submission to the NRC. III.B3-5 is correct for the LRA Table 3.5.2-2 AMR line item for phase bus enclosure assemblies, material stainless steel in air-indoor environments on page 3.5-83.

On the basis of this response, the LRA will be amended to revise Note 572 to agree with the license renewal basis calculation.

In the same August 20, 2007 letter, the applicant amended Note 572 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

During the audit and review, the staff noted that in LRA Table 3.5.2-26 on page 3.5-177 for AMR component phase bus enclosure assemblies, material stainless steel in air-indoor environments, aging effect none, Table 1, item 3.5.1-59, Note 572 refers to the GALL Report item III.B2-7. The staff asked the applicant to explain why the GALL Report item III.B2-7 is in the note as the GALL Report item III.B3-5 is shown for this Table 2 AMR line item and Table 1, item 3.5.1-59 does not refer to the GALL Report item III.B2-7.

In its letter dated August 20, 2007, the applicant stated the license renewal basis calculation has the following text for Note 572:

> The components "Phase Bus Assemblies" are aligned with III.B2-7 or III.B3-2 or III.B3-5 because they have the same material, environment, aging effect and AMP although they are not the same GALL Report component "Support members; welds, bolted connections, support anchorage to building structure."

This Note 572 change inadvertently was not incorporated into the LRA before submission to the NRC. Table 3.5.2-26, page 3.5-177, The GALL Report, Volume 2, item III.B3-5, is correct for AMR component phase bus enclosure assemblies, material stainless steel in air-indoor environments.

On the basis of this response, the LRA will be amended to revise Note 572 to agree with the license renewal basis calculation.

In the same August 20, 2007 letter, the applicant amended Note 572 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

During the audit and review, the staff noted that in LRA Table 3.5.2-17 on page 3.5-129 for AMR component canal and pool gates, material stainless steel in air-indoor environments, no aging effect, Note 545 describes new fuel storage racks as stainless steel. The staff asked the applicant to explain why Note 545 refers to canal and pool gate components.

In its letter dated August 20, 2007, the applicant stated Note 545 for AMR component canal and pool gates, material stainless steel in air-indoor environments, was incorrect and should be changed to Note 540. Note 540 should be revised to include canal and pool gates as follows:

> The components "Steel Components: All structural steel," "Steel Components: Fuel Pool Liner," "Floor Drains," "Sump Screens" or "Canal and Pool Gates" are aligned with III.B5-5 and/or III.B5-6 as "Miscellaneous Structures" because they have the same

material, environment, aging effect and AMP although they are not the same GALL Report component "Support members; welds, bolted connections, support anchorage to building structure."

The stainless steel canal and pool gates still have no aging effects but this change makes the plant-specific notes more consistent.

On the basis of this response, the LRA will be amended to revise Note 540 as in the response and AMR component canal and pool gates, material stainless steel in air-indoor environments, will be revised to delete Note 545 and add Note 540.

In the same August 20, 2007 letter, the applicant amended LRA Table 3.5.2-17 for this AMR line item to change Note 545 to Note 540 and to revise Note 540 itself accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

During the audit and review, the staff noted that in LRA Table 3.5.2-17 on page 3.5-136 for AMR component new fuel storage rack, material stainless steel in air-indoor environments, aging effect none, Table 1, item 3.5.1-59, Note 545 refers to GALL Report item III.B5-5. The staff asked the applicant to explain why GALL Report item VII.A1-1 is shown for this Table 2 AMR line item when neither Note 545 or Table 1, item 3.5.1-59 refers to GALL Report item VII.A1-1.

In its letter dated August 20, 2007, the applicant stated that the GALL Report assumed that the new fuel storage racks would be carbon steel and aligned them to the carbon steel item VII.A1-1; however, the HNP new fuel storage racks are stainless steel and GALL Report item VII.A1-1 does not apply. There is no stainless steel GALL Report item for the new fuel storage racks. Note 545 clarifies that the new fuel storage racks are stainless steel components in air-indoor environments and would be aligned to the more appropriate GALL Report, item III.B5-5, with the same material, environment, aging effect (none), and AMP (none); however, for clarification, LRA Table 3.5.2-17 on page 3.5-136 for AMR component new fuel storage rack, material stainless steel in air-indoor environments, aging effect none, Table 1, item 3.5.1-59 will be revised to replace VII.A1-1 (A-94) with III.B5-5. In addition, Note 545 will be revised as follows:

> The GALL Report assumes new fuel storage racks are carbon steel, in an air-Indoor environment, with aging effects (GALL Report, item VII.A1-1); however, the HNP new fuel storage racks are stainless steel. Stainless steel in an air-Indoor environment has no aging effects. The new fuel storage racks are aligned with GALL Report item III.B5-5 because the new fuel storage racks have the same material, environment, aging effect (none) and AMP (none) although they are not the same GALL Report component "Support members; welds, bolted connections, support anchorage to building structure."

On the basis of this response, LRA Table 3.5.2-17 on page 3.5-136 will be amended for AMR component new fuel storage rack, material stainless steel in air-indoor environments, aging effect none, Table 1, item 3.5.1-59 to replace VII.A1-1 (A-94) with III.B5-5 (TP-5) and Note 545 will be amended as stated in this response.

In the same August 20, 2007 letter, the applicant amended LRA Table 3.5.2-17 for this AMR line item to change VII.A1-1 (A-94) to III.B5-5 (TP-5) and revised Note 545 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

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).

3.5.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.5.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the containments, structures, component supports components and provides information concerning how it will manage aging effects in the following three areas:

(1) PWR and BWR containments:

- aging of inaccessible concrete areas
- 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 the Structures Monitoring Program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to general, pitting, and crevice corrosion
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- SCC
- cracking due to cyclic loading
- loss of material (scaling, cracking, and spalling) due to freeze-thaw
- cracking due to expansion and reaction with aggregate and increase in porosity and permeability due to leaching of calcium hydroxide

(2) safety-related and other structures and component supports:

- aging of structures not covered by the Structures Monitoring Program

- aging management of inaccessible areas
- reduction of strength and modulus of concrete structures due to elevated temperature
- aging management of inaccessible areas for Group 6 structures
- SCC and loss of material due to pitting and crevice corrosion
- aging of supports not covered by the Structures Monitoring Program
- cumulative fatigue damage due to cyclic loading

(3) 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 3.5.2.2.The staff's review of the applicant's further evaluation follows.

3.5.2.2.1 PWR and BWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which address several areas:

<u>Aging of Inaccessible Concrete Areas</u>.

The staff reviewed LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1.

LRA Section 3.5.2.2.1.1 addresses PWR and BWR containments: aging of inaccessible concrete areas, stating that for the containment structure the ASME Section XI, Subsection IWL Program manages aging of accessible concrete areas due to aggressive chemical attack and corrosion of embedded steel. August 2005 samples from two wells (Well 57 – pH 7.6, chlorides 290 mg/l, sulfate 2.4 mg/l, phosphate less than 500 µg/l; Well 59 - pH 7.9, chlorides 42 mg/l, sulfate 2.1 mg/l, phosphate less than 500 µg/l) indicate site groundwater is nonaggressive with no increasingly aggressive trend compared to 1973 groundwater samples. In addition, there is no external air which could concentrate contaminants via leakage or weather and present an aggressive environment. HNP is not near enough to any industrial facility or salt water environment for potential rain or leakage to concentrate contaminants in an aggressive environment. As to monitoring inaccessible areas, the below-grade containment building concrete portions are not surrounded by backfill but completely by other Class I structures. Below-grade containment building concrete cannot be examined without removal of the concrete of surrounding Class I structures; however, exposed representative portions of below-grade concrete in the same groundwater environment for the surrounding Class I structures are examined when uncovered during removal of backfill. This examination is equivalent to examination of the containment concrete.

In addition, the Structures Monitoring Program monitors groundwater periodically with consideration of potential seasonal variations.

SRP-LR Section 3.5.2.2.1.1 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 may occur in inaccessible areas of PWR and BWR concrete and steel containments. The existing program relies on ASME Code Section XI, Subsection IWL to manage these aging effects; however, the GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas in aggressive environments.

The staff determined through discussions with the applicant's technical personnel that increased 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 for inaccessible HNP containment concrete areas due to nonaggressive groundwater and air environments; however, the applicant will examine exposed portions of below grade concrete for similar Class I structures when excavation for any reason occurs. Periodic monitoring of groundwater chemistry for aggressiveness with consideration of seasonal variations will be by the applicant's Structures Monitoring Program. As the inaccessible containment areas are not in an aggressive environment, the applicant's ASME Section XI, Subsection IWL Program is adequate to manage these aging effects and no additional plant-specific program is required.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.1 criteria. For those line items that apply to LRA Section 3.5.2.2.1.1, 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).

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 the Structures Monitoring Program

The staff reviewed LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2.

LRA Section 3.5.2.2.1.2 addresses PWR and BWR containments: 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 if not covered by the Structures Monitoring Program, stating that for the containment structure aging effects due to settlement are managed by the Structures Monitoring Program with no reliance on a de-watering system for control of settlement. The containment structure was founded on unrippable rock and settlement was essentially zero during construction as documented in NRC Inspection Report 50-400/97-07 dated August 27, 1997. No cracking due to settlement is expected; however, the Structures Monitoring Program examines concrete for cracking and is credited for managing that aging effect.

The GALL Report on erosion of porous concrete subfoundations does not apply to the containment structure, which has no porous concrete subfoundation. There is a system of porous concrete drainage channels within the working slab under the containment basemat in a spoke-like pattern with 6-in. wide and 4-in. high spokes; therefore, the basemat rests not entirely on the porous concrete. Water sample and site structural walkdown results exhibit no signs of degradation of the porous concrete material within the basemat as detailed in NRC Information Notice 97-11. A dewatering system removes groundwater leakage through the waterproofing membrane under the containment building basemat but is not relied upon to control erosion of cement from porous concrete or to manage settlement.

SRP-LR Section 3.5.2.2.1.2 states that cracks and distortion due to increased stress levels from settlement may occur in PWR and BWR concrete and steel containments. Also, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations may occur in all types of PWR and BWR containments. The existing program relies on structures monitoring to manage these aging effects. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is within the scope of the applicant's structures monitoring program.

The staff determined through discussions with the applicant's technical personnel that cracks and distortion due to increased stress levels from settlement are covered by the applicant's Structures Monitoring Program and no further evaluation is required; however, the staff finds reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations implausible aging effects due to the absence of any aging mechanism. There is no porous concrete subfoundation below the containment structure of concern as subject to erosion. The staff determined that these containment aging effects are not present.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.2 criteria. For those line items that apply to LRA Section 3.5.2.2.1.2, 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).

<u>Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature</u>

The staff reviewed LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3.

LRA Section 3.5.2.2.1.3 addresses PWR and BWR containments: reduction of strength and modulus of concrete structures due to elevated temperature, stating that these aging effects are not applicable because no containment concrete structural components exceed the specified temperature limits.

SRP-LR Section 3.5.2.2.1.3 states that reduction of strength and modulus of concrete due to elevated temperatures may occur in PWR and BWR concrete and steel containments. The implementation of 10 CFR 50.55a and ASME Code Section XI, Subsection IWL would not be able to identify the reduction of strength and modulus of concrete due to elevated temperature. Subsection CC-3400 of ASME Code Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period.

The staff determined through discussions with the applicant's technical personnel that reductions of strength and modulus for concrete structures due to elevated temperature are not plausible aging effects due to the absence of these aging mechanisms. The applicant states that aging effects due to elevated temperature are not likely for the containment concrete as general area temperatures within the containment do not exceed 150 °F and local area temperatures do not exceed 200 °F. The staff determined that these containment aging effects are not present.

On the basis that there are no components from this group, the staff concludes that this aging effect is not present.

Loss of Material Due to General, Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4.

LRA Section 3.5.2.2.1.4 addresses PWR and BWR containments: loss of material due to general, pitting and crevice corrosion, stating that the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J Programs manage the aging effect for the containment liner, liner anchors, and attachments.

Loss of material due to corrosion is not significant for inaccessible areas (embedded containment steel liner) that meet specified conditions as follows:

(1) Concrete meeting ACI Standards 318 and 349 is in contact with the embedded steel liner. ACI 211.1-74, which guided concrete mix proportions, provides guidance similar to that of ACI 201.2R for high-density, low-permeability concrete mix designs.
(2) The ASME Section XI, Subsection IWE Program monitor the containment liner for corrosion or degraded protective coatings.
(3) The ASME Section XI, Subsection IWE Program monitors the moisture barrier for aging effects.
(4) Borated water spills and water ponding on the containment building floor are not common and are cleaned up promptly when detected. The containment floor design collects water in a sump area and pumps it out.

SRP-LR Section 3.5.2.2.1.4 states that loss of material due to general, pitting, and crevice corrosion may occur in steel elements of accessible and inaccessible areas for all types of PWR and BWR containments. The existing program relies on ASME Code Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. The GALL

Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if corrosion is significant.

The staff's audit and review found all GALL Report criteria satisfied. The LRA states that design of the containment concrete in contact with the steel liner plate in accordance with ACI 318 and ACI 349 meets guideline ACI 211.1-74 for concrete mix proportions similar to ACI 201.2R guidance for high-density, low-permeability concrete mix designs. Accessible containment structure concrete is monitored for penetrating cracks by the applicant's ASME Section XI, Subsection IWL Program. In addition, the applicant stated, accessible steel liner plate and moisture barrier portions where the liner becomes embedded are inspected by the ASME Section XI, Subsection IWE Program. Spills (*e.g.*, borated water) and water ponding on the containment building floor are uncommon and cleaned up promptly when detected. Operating experience demonstrates that the aging effect of loss of material due to corrosion of the liner plate has been insignificant. The staff finds that no additional plant-specific AMP is required to manage inaccessible containment steel liner plate areas.

During the audit and review, the staff noted that the discussion column in LRA Table 3.5.1, item 3.5.1-06 refers to LRA Subsection 3.5.2.2.1.4, which states: "ACI 201.2R was not used as guidance for concrete mix proportions, but ACI 211.1-74 was used." ACI 211.1-74 guides production of high-density, low-permeability concrete mix designs similar to ACI 201.2R. The staff asked the applicant to compare similarities and differences between ACI 201.2R and ACI 211.1-74 for concrete mix proportion design as to HNP concrete specifications.

The applicant stated that the design of concrete mix in contact with the containment liner (LRA Table 3.5.1, item 3.5.1-06) was in accordance with ACI 211.1-74, "Recommended Practice for Selecting Proportions for Normal and Heavy Weight Concrete," and with Article CC-2232 of ASME Code Section III, Division 2/ACI 359 (FSAR 3.8.1.6.1(f)). LRA Section 3.5.2.2.1.4 addresses loss of material due to corrosion for the containment liner, liner anchors, and attachments. FSAR Section 3.8.1.5.4 states, "The alkaline environment of the concrete adequately protects embedded steel parts from corrosion." ACI 201.2R (Section 4.5.1.1) states, "Low water-cement ratios produce less permeable concrete and thus provide greater assurance against corrosion." Therefore, water-cement ratio is of primary importance in LRA Section 3.5.2.2.1.4.

Selection of the water-cement methodology is the same in ACI 211.1-74 (Table 5.3.4(b)) and ACI 201.2R, "Guide to Durable Concrete." ACI 211-74 specifies a maximum water-cement ratio of 0.50 for "all other structures" with a footnote citing ACI 201. ACI 201.2R (Section 1.4.2) also specifies a maximum water-cement ratio of 0.50 for "all other structures." The containment concrete should be in the "all other structures" category. The actual concrete mix designs at for HNP containment concrete were within the water-cement ratio specified in both ACI standards.

Air entrainment is also an important element in the design of durable, low-permeability concrete. Selection of the air content is similar in the two ACI standards. ACI 211-74 (Table 5.3.3) specifies an approximate average air content of 6 percent for ¾-inch aggregate and 4½ percent for 1½-inch aggregate and Section 5.3.3 refers to ACI 201 on air content recommendations. ACI 201.2R (Table 1.4.3) recommends an average air content of 5 percent for ¾-inch aggregate and 4½ percent for 1½-inch aggregate with a 1½ percent tolerance (or

6½ percent and 6 percent respectively). The actual HNP mix designs for the containment allowed up to 8-percent air entrainment for two of the three mixes (less than or equal to ¾-inch maximum size aggregate), slightly higher than 6½ percent and 6 percent; however, the HNP concrete mix designs allowed the higher air content and still exceeded concrete design strength requirements.

ACI 201.2R (Sections 1.4 and 1.4.4) recommends suitable materials for durable, low-permeability concrete. Although not addressed specifically in ACI 211-74, FSAR Section 3.8.1.6.1 and the original concrete specification indicate concrete materials consistent with ACI 201.2R.

ACI 201.2R (Section 4.5.1.1) but not ACI 211-74 recommends lower water-cement ratios for concrete in seawater or brackish water (0.40); however, this recommendation does not apply.

The original HNP concrete specification specified a water-cement ratio between 0.44 and 0.60 and air content between 4 and 8 percent for ¾-inch and 3 and 6 percent for 1½-inch maximum aggregate size. The actual mix design for the containment concrete was within the water-cement ratio and air content limits in the original HNP concrete specification.

Finally, the applicant stated that operating experience shows no aging effects, including loss of material due to corrosion, for containment concrete related to mix designs.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.4 criteria. For those line items that apply to LRA Section 3.5.2.2.1.4, 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).

Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature.

LRA Section 3.5.2.2.1.5 states that loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature is not present as there are no prestressed tendons for the containment building structure.

Cumulative Fatigue Damage

LRA Section 3.5.2.2.1.6 states that fatigue is a TLAA as defined in 10 CFR 54.3 for the bellows expansion joints of the two containment spray and two safety-injection system recirculation valve chambers and for the expansion bellows of the fuel transfer tube in the fuel handling building. The evaluation of this TLAA is in SER Section 4.6. Other containment mechanical penetration bellows are outside the containment building and screened out of scope of license renewal because they perform no containment building pressure boundary intended function. There is no fatigue analysis for penetration sleeves and dissimilar metal welds like those between penetration-flued heads to the penetration sleeves. The GALL Report BWR components (*i.e.,* suppression pool shell and unbraced downcomers) are not present in the HNP containment.

Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.6 documents the staff's review of the applicant's evaluation of this TLAA.

Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7.

LRA Section 3.5.2.2.1.7 addresses PWR and BWR containments: SCC, stating that this aging effect is not present because: (1) carbon steel components are not susceptible to SCC, and (2) to be susceptible to SCC, stainless steel must be subjected to both high temperature (greater than 140 °F) and an aggressive chemical environment. SCC is not an aging effect for the stainless steel penetration sleeves and bellows because these components are not subject to aggressive chemical environments.

SRP-LR Section 3.5.2.2.1.7 states that SCC of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds may occur in all types of PWR and BWR containments.

The staff determined through discussions with the applicant's technical personnel that conditions necessary for SCC of penetration sleeves and bellows and dissimilar metal welds are not present.

On the basis that the conditions necessary for SCC are not present, the staff concludes that this aging effect is absent.

Cracking Due to Cyclic Loading

The staff reviewed LRA Section 3.5.2.2.1.8 against the criteria in SRP-LR Section 3.5.2.2.1.8.

LRA Section 3.5.2.2.1.8 addresses PWR and BWR containments: cracking due to cyclic loading, stating that the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J Programs manage such cracking for containment penetration sleeves and the two containment spray and two safety injection system recirculation valve chamber bellows expansion joints. The remaining mechanical penetration bellows are screened out of scope of license renewal because they perform no containment structure pressure boundary intended function. The applicant has found no operating experience for the aging effect of fine cracking of the penetrations and bellows and does not expect it to occur. The aging effect of fine cracking is a result of cyclic loading or fatigue. TLAA evaluations for fatigue of bellows expansion joints and the piping attached to the penetration sleeves project the number of fatigue cycles for 60 years of operation as fewer than the design number for 40 years. The ASME Section XI, Subsection IWE Program and the 10 CFR Part 50 Appendix J Program are adequate for monitoring the aging effects for penetrations and bellows due to cyclic loading.

SRP-LR Section 3.5.2.2.1.8 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) may occur in all types of PWR and BWR containments and BWR vent header, vent line bellows, and downcomers. The existing program relies on ASME Code Section XI, Subsection IWE and 10 CFR Part 50, Appendix J, to manage this aging effect; however, visual examination (VT-3) may not detect fine cracks. The GALL Report recommends further evaluation for detection of this aging effect.

The staff determined through discussions with the applicant's technical personnel that fine cracking of containment penetration sleeves and bellows is not likely because there is no significant cyclic loading on these components. The applicant's ASME Section XI, Subsection IWE Program and 10 CFR Part 50 Appendix J Program are adequate for detecting cracking for penetrations and bellows without the need for any additional program or augmented inspections to detect fine cracks.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.8 criteria. For those line items that apply to LRA Section 3.5.2.2.1.8, 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).

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.

LRA Section 3.5.2.2.1.9 addresses PWR and BWR containments: loss of material (scaling, cracking, and spalling) due to freeze-thaw, stating that the plant is located within a moderate weathering zone. The ASME Section XI, Subsection IWL Program manages loss of material due to freeze-thaw for the containment cylinder wall and dome portion exposed to an outdoor environment. The only part of the containment building subject to freeze-thaw is the accessible cylinder wall and dome extending above the reactor auxiliary and fuel handling buildings. Examinations of accessible concrete per the ASME Section XI, Subsection IWL Program have detected no loss of material or cracking due to freeze-thaw as an aging effect. Inaccessible containment building concrete areas are surrounded by an indoor environment and not subject to freeze-thaw weathering conditions.

SRP-LR Section 3.5.2.2.1.9 states that loss of material (scaling, cracking, and spalling) due to freeze-thaw may occur in PWR and BWR concrete containments. The existing program relies on ASME Code Section XI, Subsection IWL to manage this aging effect. The GALL Report recommends further evaluation of this aging effect for plants located in moderate to severe weather conditions

The staff determined through discussions with the applicant's technical personnel that HNP is located within a moderate weathering zone and that accessible containment areas subject to loss of material due to freeze-thaw are managed under the ASME Section XI, Subsection IWL

Program. Inaccessible containment building concrete areas are surrounded by an indoor environment and not subject to freeze-thaw weathering conditions. No augmented or additional program is required to detect loss of material due to freeze-thaw in containment inaccessible areas.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.9 criteria. For those line items that apply to LRA Section 3.5.2.2.1.9, 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).

Cracking Due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide

The staff reviewed LRA Section 3.5.2.2.1.10 against the criteria in SRP-LR Section 3.5.2.2.1.10.

LRA Section 3.5.2.2.1.10 addresses PWR and BWR containments: permeability due to leaching of calcium hydroxide, stating that the ASME Section XI, Subsection IWL Program manages aging effects for accessible containment structure concrete. Concrete construction for inaccessible areas was to ACI 211.1-74, which provides guidance similar to that of ACI 201.2R for high-density, low-permeability concrete mix designs; therefore, a potential increase in porosity and permeability due to leaching of calcium hydroxide is not an aging effect requiring management.

For cracking due to reaction with aggregates, selection of nonreactive concrete aggregates was per ASTM C33, which uses ASTM C227 and ASTM C295.

SRP-LR Section 3.5.2.2.1.10 states that cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide may occur in concrete elements of PWR and BWR concrete and steel containments. The existing program relies on ASME Code Section XI, Subsection IWL to manage these aging effects. The GALL Report recommends further evaluation if concrete was not constructed in accordance with American Concrete Institute (ACI) 201.2R-77 recommendations.

The staff's audit and review found the GALL Report criteria satisfied and no augmented or additional AMPs required for inaccessible containment areas. The LRA states that concrete construction of inaccessible containment areas meets ACI 211.1-74 requirements for concrete mix proportions similar to those of ACI 201.2R for high-density, low-permeability concrete mix designs. The applicant's ASME Section XI, Subsection IWL Program monitors accessible containment structure concrete for cracking. In addition, the applicant stated, the concrete aggregates are nonreactive for cracking per ASTM C33, which uses ASTM C227 and ASTM C295.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.10 criteria. For those line items that apply to LRA Section 3.5.2.2.1.10, 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).

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

The staff reviewed LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which address several areas:

Aging of Structures Not Covered by Structures Monitoring Program

The staff reviewed LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

LRA Section 3.5.2.2.2.1 addresses aging of safety-related and other structures and component supports not covered by the Structures Monitoring Program, stating that the following aging mechanisms are not applicable to containment internal structural concrete, including the refueling canal concrete, because of its location but that the Structures Monitoring Program inspects accessible portions.

- Freeze-Thaw
- Aging effects due to increased stress levels from settlement
- Erosion of porous concrete subfoundation
- Aggressive chemical attack (for below-grade concrete)
- Corrosion of embedded steel (for below-grade concrete)
- Leaching of calcium hydroxide (for concrete foundations)

The containment internal structures are in and supported by the containment building, not on soil or on a porous concrete subfoundation, nor are they exposed to outdoor environments. Aging effects due to settlement are managed by the Structures Monitoring Program for the containment building.

For structures outside the containment building, aging effects due to settlement are managed by the Structures Monitoring Program or, for the auxiliary dam and spillway and main dam and spillway, the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program with no de-watering system relied upon for control of settlement. None of the HNP structures within the scope of license renewal has a porous subfoundation.

SRP-LR Section 3.5.2.2.2.1 states that the GALL Report recommends further evaluation of certain structure-aging effect combinations not covered by structures monitoring programs, including (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, (2) 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, (3) loss of material due to corrosion for Groups 1-5, 7, and 8 structures, (4) loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, and 7-9 structures, (5) cracking due to expansion and reaction with aggregates for Groups 1-5 and 7-9 structures, (6) cracks and distortion due to increased stress levels from settlement for Groups 1-3 and 5-9 structures, and (7) reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures. The GALL Report recommends further evaluation only for structure-aging effect combinations not within structures monitoring programs. In addition, lock up due to wear may occur in Lubrite radial beam seats in BWR drywells, 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 structures monitoring or ASME Code Section XI, Subsection IWF, to manage this aging effect. The GALL Report recommends further evaluation only for structure-aging effect combinations not within the ISI (IWF) or structures monitoring programs.

The staff finds that the applicant has included first 5 (1-5) and last (8) structures and aging effect combinations in its Structures Monitoring Program with no further evaluation required in accordance with the GALL Report. For Groups 1-3 and 5-9 structures, the aging effects cracks and distortion due to increased stress levels from settlement (6) are managed by the Structures Monitoring Program except for the auxiliary dam and spillway and main dam and spillway. The RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program inspects for cracks and distortion due to increased stress levels from settlement for these two structures. The staff's evaluation of the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program is documented in SER Section 3.0.3.2.25. This program inspects concrete dams for structural cracking resulting from overstress due to applied loads, shrinkage and temperature effects, or differential movements (*e.g.*, settlement) and for evidence of any abnormal settlements, heaving, deflections, or lateral movements.

Because the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program requirements for inspection and detection of cracking due to increased stress levels from settlement are essentially the same as those of the applicant's Structures Monitoring Program, the staff finds it an acceptable AMP for cracking of the auxiliary dam and spillway and main dam and spillway.

For reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures (number 7 structures and aging effect combination) the staff determined that no HNP structure within the scope of license renewal has a porous subfoundation and that neither this inspection nor further evaluation is required of the Structures Monitoring Program.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.1 criteria. For those line items that apply to LRA Section 3.5.2.2.2.1, 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).

Aging Management of Inaccessible Areas

The staff reviewed LRA Section 3.5.2.2.2.2 against the following criteria in SRP-LR Section 3.5.2.2.2.2:

(1) LRA Section 3.5.2.2.2.2 addresses aging management of freeze-thaw in inaccessible areas, stating that the Structures Monitoring program manages loss of material and cracking of concrete for the containment internal structures, including the refueling canal. HNP is located within a moderate weathering zone; however, the containment Internal concrete, both accessible and inaccessible, is inside the containment building, not exposed to an outdoor environment, and, therefore, not subject to freeze-thaw.

For other structures outside the containment within the scope of license renewal and subject to freeze-thaw, the concrete design varied depending on the safety classification of the structure. Safety-related structures were designed with Class 1, others with Non-Class 1, concrete. HNP is located in a moderate weathering zone.

HNP Class 1 concrete was constructed to ACI 211.1-74, which provides guidance similar to that of ACI 201.2R for high-density, low-permeability concrete for concrete mix designs. Non-Class 1 concrete was not required per plant specifications to meet ACI 201.2R-77 water-cement ratios; however, Non-Class 1 concrete was designed to ACI 318-71 and ACI 301-72 requirements and plant specifications. Subsequent inspections have found no degradation due to freeze-thaw for either Class 1 or Non-Class 1 concrete. Nevertheless, inaccessible Non-Class 1 concrete of structures within the scope of license renewal will be examined when excavated for any reason.

Structures constructed in whole or in part with Non-Class 1 concrete are the auxiliary dam and spillway, cooling tower, circulating water intake structure, main dam and spillway, outside the power block structures, security building, NSW intake structure, switchyard relay building, transformer and switchyard structures, turbine building, and yard structures. The auxiliary dam and spillway and main dam and spillway are Group 6 structures.

SRP-LR Section 3.5.2.2.2.2 states that loss of material (spalling, scaling) and cracking due to freeze-thaw may 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 weather conditions.

The staff determined through discussions with the applicant's technical personnel that loss of material (spalling, scaling) and cracking due to freeze-thaw for inaccessible areas of Groups 1-3, 5, and 7-9 structures are not plausible aging effects because concrete construction is in accordance with ACI and ASTM standards with a high cement, low water-cement ratio and because HNP is located in a moderate weathering zone. Although the water-cement ratio falls outside the listed range of 0.35 to 0.45 and the air content falls outside the 3 to 6 percent range, within all parameters of concrete mix design HNP meets

ACI quality requirements for acceptable concrete; however, aging effects for inaccessible areas of these groups are included within the Structures Monitoring Program.

During the audit and review, the staff noted that LRA Table 3.5.1, item 3.5.1-26 refers to GALL Report item III.A3-6. The staff asked the applicant for HNP original concrete specifications to confirm that existing concrete had air content of 3 to 6 percent and water-cement ratio of 0.35-0.45 when poured.

In its letter dated August 20, 2007, the applicant stated the actual concrete mix design for the Class I structures monitored by the Structures Monitoring Program had air content ranging from 3 to 8 percent and water-cement ratios up to 0.50. The actual concrete mix design for the non-Class I structures monitored by the Structures Monitoring Program had air content ranging from 3 to 8 percent and water-cement ratios up to 0.592.

Because actual mix designs exceed GALL Report limits, LRA Section 3.5.2.2.2.2.1 states that HNP will examine inaccessible non-Class I concrete in structures within the scope of license renewal when excavated for any reason. LRA Table 1, item 3.5.1-26 states that the Structures Monitoring Program manages aging effects of loss of material and cracking due to freeze-thaw for accessible concrete of safety-related and nonsafety-related structures. In addition, although not stated in LRA Section 3.5.2.2.2.2.1 or Table 1, item 3.5.1-26, all inaccessible concrete (non-Class I and Class I) will be examined for loss of material and cracking whenever exposed for any reason prior to backfilling as stated in the LRA under the Structures Monitoring Program in the enhancements for "scope of the program" and "parameters monitored or inspected."

Details are available at HNP for review in the bases and other reference documents.

For clarification, LRA Section 3.5.2.2.2.2.1 will be revised to that state inaccessible Class I concrete in structures within the scope of license renewal will be examined for loss of material and cracking whenever exposed for any reason. On the basis of this response, the LRA will be amended to incorporate this clarification to LRA Section 3.5.2.2.2.2.1.

In the same August 20, 2007 letter, the applicant amended LRA Section 3.5.2.2.2.2.1 accordingly.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

(2) LRA Section 3.5.2.2.2.2.2 addresses aging management of reaction with aggregates in inaccessible areas, stating that the concrete in inaccessible areas of the containment internal structure, including the refueling canal, and the reactor auxiliary, diesel generator, and diesel fuel oil storage tank buildings, the fuel handling building, the HVAC equipment room (located on the roof of the reactor auxiliary building), the tank area/building, the waste processing building, and portions of the turbine building and yard structures that use Class 1 concrete areas was constructed to ACI 211.1-74, which

provides guidance similar to that of ACI 201.2R for concrete mix designs for high-density, low-permeability concrete. These structures are not susceptible to concrete expansion cracking due to reaction with aggregates; the nonreactive concrete aggregates were selected per ASTM C33, which uses ASTM C227 and ASTM C295.

Plant specifications did not require Non-Class 1 concrete to meet ACI 201.2R-77 water-cement ratios; however, Non-Class 1 concrete used the same nonreactive aggregates as Class 1 concrete and was designed to ACI 318-71 and ACI 301-72 requirements and to plant specifications. Subsequent inspections have found no degradation due to reaction with aggregates. Nevertheless, inaccessible Non-Class 1 concrete in the construction of the structures within the scope of license renewal will be examined when excavated for any reason. Structures subject to examination are the Non-Class 1 concrete of the cooling tower, circulating water intake structure, NSW intake structure, outside the power block structures, security building, switchyard relay building, transformer and switchyard structures, turbine building, and yard structures.

SRP-LR Section 3.5.2.2.2.2 states that cracking due to expansion and reaction with aggregates may 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 ACI 201.2R-77 recommendations.

The staff determined through discussions with the applicant's technical personnel that cracking due to expansion and to reaction with aggregates for inaccessible areas of Group 1-5 and 7-9 structures are not plausible aging effects due to concrete construction in accordance with ACI and ASTM standards with a high cement, low water-cement ratio. Although the water-cement ratio falls outside the listed range of 0.35 to 0.45 and the air content falls outside the 3 to 6 percent range (SER Section 3.5.2.2.2.2.1), within all parameters of concrete mix design, HNP concrete meets ACI quality requirements for acceptable concrete. In addition, the staff determined that the inaccessible concrete is not susceptible to cracking from expansion due to reaction with aggregates selected per ASTM C33, which uses ASTM C227 and ASTM C295. These aggregates are not reactive; however, aging effects for inaccessible areas of these groups are within the Structures Monitoring Program. Inspections of inaccessible areas will proceed when excavation occurs for any reason.

(3) LRA Section 3.5.2.2.2.2 addresses aging management of increased stress levels from settlement and erosion of porous concrete in inaccessible areas, stating that the refueling canal concrete (a GALL Report Group 5 structure included with the containment internals concrete) is supported within the containment building, not on a porous concrete subfoundation, and does not rely on a dewatering system. Structures outside the containment building also do not rely on a de-watering system for control of settlement. None of the structures within the scope of license renewal has a porous subfoundation.

As to settlement, structures within the scope of license renewal were founded on sound and unrippable rock except the cooling tower, circulating water intake structure, security building, NSW intake structure, switchyard relay building, transformer and switchyard structures, and some yard structures supported on sound rock, engineered fill, or undisturbed soil. The outside the power block structure fuel handling building retaining wall is supported on modified random fill. Since construction, the retaining wall required monitoring and evaluation until settlement stabilized lateral movement. Currently, monitoring and evaluation of the retaining wall is by engineering periodic test. To date, no adverse plant-specific operating experience has been recorded. The retaining wall has no porous concrete subfoundation.

Settlement for safety-related structures was essentially zero during construction as documented in NRC Inspection Report 50-400/97-07 dated August 27, 1997. No cracking due to settlement is expected; however, the Structures Monitoring Program or, for the auxiliary dam and spillway and the main dam and spillway, the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, examines concrete for cracking and is credited for managing the aging effect of cracking. Likewise, no cracking due to settlement is expected for structures within the scope of license renewal not founded on sound rock. For these structures also the Structures Monitoring Program examines concrete for cracking and is credited for managing that aging effect.

SRP-LR Section 3.5.2.2.2.2 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 may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures. The existing program relies on structures monitoring to manage these aging effects. Some plants may rely on de-watering systems to lower site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the system's continued functionality during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included within the scope of the applicant's Structures Monitoring Program.

The staff finds that for below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures, the aging effects of cracking and distortion due to increased stress levels from settlement are managed by the Structures Monitoring Program except for the auxiliary dam and spillway and main dam and spillway, which are Group 6 structures; therefore, no further evaluation is required. All inaccessible concrete will be examined for cracks and distortion whenever below-grade concrete is exposed for any reason prior to backfilling. The RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program inspects for the cracks and distortion due to increased stress levels from settlement for the two Group 6 structures. The staff's evaluation of the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program is documented in SER Section 3.0.3.2.25. This program inspects concrete dams for structural cracking resulting from overstress due to applied loads, shrinkage and temperature effects, differential movements (*e.g.*, settlement), and evidence of any abnormal settlements, heaving, deflections, or lateral movements.

Although Group 6 structures, because the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program requirements for inspection and detection of cracking due to increased stress levels from settlement are essentially the same as those for the applicant's Structures Monitoring Program, the staff finds it an acceptable AMP for cracking of auxiliary dam and spillway and main dam and spillway components.

For reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations for below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures; the staff determined that no HNP structure within the scope of license renewal has a porous subfoundation and that neither this inspection nor further evaluation is required of the Structures Monitoring Program.

(4) LRA Section 3.5.2.2.2.2 addresses aging management of aggressive chemical attack and corrosion of embedded steel in inaccessible areas, stating that this aging effect is not present because the containment refueling canal concrete is not in a soil environment but supported within the containment building.

SRP-LR Section 3.5.2.2.2.2 states that increase in porosity and permeability, cracking, and 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 may 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 these aging effects in inaccessible areas of such groups of structures in aggressive environments.

The staff determined through discussions with the applicant's technical personnel that increased 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 for below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures due to nonaggressive groundwater and air environments; however, the Structures Monitoring Program will examine exposed portions of below-grade concrete for such structures whenever excavated for any reason. Periodic monitoring of groundwater chemistry for aggressiveness with consideration of seasonal variations also will proceed under the Structures Monitoring Program. As Groups 1-3, 5, and 7-9 structures in inaccessible areas are not in aggressive environments, the Structures Monitoring Program is adequate to manage these aging effects with no additional plant-specific program required.

(5) LRA Section 3.5.2.2.2.2 addresses aging management of leaching of calcium hydroxide in inaccessible areas, stating that the aging effect is not present because the containment refueling canal concrete is inside the containment in the containment air environment and has no exterior above- or below-grade foundation. For inaccessible areas in structures outside the containment building, construction of safety-related, Class 1 concrete was to ACI 211.1-74 for high-density, low-permeability concrete similar to ACI 201.2R for concrete mix designs; therefore, no AMP is required for inaccessible areas of safety-related structures outside the containment building. Non-Class 1 concrete was not required per HNP specifications for ACI 201.2R-77 water-cement ratios; however, non-Class 1 concrete was designed to ACI 318-71, ACI 301-72, and plant specifications. Subsequent inspections have found no degradation due to leaching of calcium hydroxide. Because ACI 201.2R-77 recommendations were not specified,

inaccessible non-Class 1 concrete in the construction of structures within the scope of license renewal will be examined under the Structures Monitoring Program whenever excavated for any reason. SER Section 3.5.2.2.2.2.1 lists structures of non-Class 1 concrete.

SRP-LR Section 3.5.2.2.2.2 states that increased porosity and permeability, and loss of strength due to leaching of calcium hydroxide may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures.

The staff's audit and review found GALL Report criteria satisfied and no further evaluation of any need of augmented or additional AMPs required for below-grade inaccessible concrete areas of Class 1 Groups 1-3, 5, and 7-9 structures. The LRA states that concrete construction for below-grade inaccessible areas of Class 1 Groups 1-3, 5, and 7-9 structures meets ACI 211.1-74 for concrete mix proportions similar to ACI 201.2R for high-density, low-permeability concrete mix designs. Although the Class 1 concrete water-cement ratio falls outside the listed range of 0.35 to 0.45 and the air content falls outside the 3 to 6 percent range (SER Section 3.5.2.2.2.2.1), within all parameters of concrete mix design, HNP concrete meets ACI quality requirements for acceptable concrete.

However, design of non-Class 1 concrete for Groups 1-3, 5, and 7-9 structures was to ACI 318-71, ACI 301-72, and plant specifications. Subsequent inspections have found no degradation due to leaching of calcium hydroxide. Because ACI 201.2R-77 recommendations were not specified, inaccessible non-Class 1 concrete in the construction of Groups 1-3, 5, and 7-9 structures within the scope of license renewal will be examined under the Structures Monitoring Program whenever excavated for any reason.

During the audit and review, the staff noted that LRA Table 3.5.1, item 3.5.1-32, refers to LRA Subsections 3.5.2.2.2.1 and 3.5.2.2.2.2.5 in the discussion column. Subsection 3.5.2.2.2.2.5 states: "For inaccessible areas in structures outside the containment building, safety-related, Class 1 concrete was constructed to ACI 211.1-74, which guides production of high-density, low permeability concrete similar to ACI 201.2R for concrete mix designs; therefore, no AMP is required for inaccessible areas in safety-related structures outside the containment building;" however, LRA Table 1, item 3.5.1-32 is in AMR Tables 3.5.2-2, 3.5.2-10, 3.5.2-12, 3.5.2-17, 3.5.2-27 and 3.5.2-28 for exterior below grade and foundation concrete for managing the aging effect of change in material properties with the Structures Monitoring Program. The staff asked the applicant to explain the contradiction as these six AMR tables are for safety-related structures but Subsection 3.5.2.2.2.2.5 states that no AMP is required.

In its letter dated August 20, 2007, the applicant stated that the LRA inadvertently included Table 1, item 3.5.1-32 on AMR Tables 3.5.2-2, 3.5.2-10, 3.5.2-12, 3.5.2-17, 3.5.2-27, and 3.5.2-28 for the concrete exterior below grade and concrete foundation component/commodity groups. Table 1, item 3.5.1-32 should be removed from AMR Tables 3.5.2-2, 3.5.2-10, 3.5.2-12, 3.5.2-17, 3.5.2-27 and 3.5.2-28 for such component/commodity groups.

In the same August 20, 2007 letter, the applicant amended LRA Table 1, item 3.5.1-32 from the AMR tables for exterior below grade and foundation concrete component/commodity groups.

On the basis of its review, the staff finds the response acceptable. The applicant appropriately addressed the aging effect or mechanism as recommended by the GALL Report.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.2 criteria. For those line items that apply to LRA Section 3.5.2.2.2.2, 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).

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.

LRA Section 3.5.2.2.2.3 addresses reduction of strength and modulus of concrete structures due to elevated temperature, stating that this aging effect is not present because neither the containment internal concrete nor the concrete structural components for other structures outside containment exceed the specified temperature limits.

SRP-LR Section 3.5.2.2.2.3 states that reduction of strength and modulus of concrete due to elevated temperatures may occur in PWR and BWR Groups 1-5 concrete structures. For concrete elements that exceed specified temperature limits, further evaluations are recommended. Appendix A to ACI 349-85 specifies the concrete temperature limits for normal operation or any other long-term period. Temperatures shall not exceed 150 °F except for local areas allowed to have temperatures not to exceed 200 °F.

The staff determined through discussions with the applicant's technical personnel that reduction of strength and modulus for Groups 1-5 concrete structures due to elevated temperature are not plausible aging effects due to the absence of these aging mechanisms. The applicant states that aging effects due to elevated temperature are not likely at HNP for Group 1-5 concrete structures because general area temperatures within the structures do not exceed 150 °F and local area temperatures do not exceed 200 °F. The staff determines that these aging effects are not present in HNP Group 1-5 structures.

On the basis that there are no components from this group, the staff concludes that this aging effect is not present.

Aging Management of Inaccessible Areas for Group 6 Structures

The staff reviewed LRA Section 3.5.2.2.2.4 against the following criteria in SRP-LR Section 3.5.2.2.2.4:

(1) LRA Section 3.5.2.2.2.4 addresses aging management of aggressive chemical attack and corrosion of embedded steel inaccessible areas for Group 6 structures, stating that the groundwater chemistry and main and auxiliary reservoir water chemistry are nonaggressive.

SRP-LR Section 3.5.2.2.2.4 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 may 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 in aggressive environments.

The staff determined through discussions with the applicant's technical personnel that increased 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 for below-grade inaccessible concrete areas of Group 6 structures due to non-aggressive groundwater and environments; however, examinations under the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, the Structures Monitoring Program, or both of exposed portions of below-grade concrete for Group 6 structures will proceed whenever excavated for any reason occurs. Periodic monitoring of groundwater chemistry for aggressiveness with consideration of seasonal variations and of reservoir chemistry also will proceed under the applicant's Structures Monitoring Program. As the Group 6 structure inaccessible areas are not in aggressive environments, the applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program and/or Structures Monitoring Program is adequate to manage these aging effects and no additional plant-specific program is required.

(2) LRA Section 3.5.2.2.2.4 addresses aging management of freeze-thaw in inaccessible areas for Group 6 structures, stating that the plant is located within a moderate weathering zone. The only normally inaccessible *(i.e.*, below water level) portions of the water control structures potentially exposed to freeze-thaw are the concrete members subject to wave action and a few inches below the water surface; however, ice has not been observed at Class 1 Water Control Structures in other than isolated coves. Only outside areas are monitored by the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program. Although no aging effect is expected, examinations per this program are adequate to detect cracking and loss of material due to freeze-thaw.

SRP-LR Section 3.5.2.2.2.4 states that loss of material (spalling, scaling) and cracking due to freeze-thaw may 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 weather conditions.

The staff determined through discussions with the applicant's technical personnel that loss of material (spalling, scaling) and cracking due to freeze-thaw for below-grade inaccessible concrete areas of Group 6 structures are not plausible aging effects due to concrete construction in accordance with ACI and ASTM standards with a high cement, low water-cement ratio and HNP's location in a moderate weathering zone. Although the water-cement ratio falls outside the listed range of 0.35 to 0.45 and the air content falls outside the 3 to 6 percent range (SER Section 3.5.2.2.2.2.1), within all parameters of concrete mix design, HNP concrete meets ACI quality requirements of ACI for acceptable concrete; however, aging effects for Group 6 concrete members a few inches below the water surface and subject to wave action are within the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program. The staff finds the applicant adequately addressed further evaluation of this aging effect.

(3) LRA Section 3.5.2.2.2.4 addresses aging management of reaction with aggregates and leaching of calcium hydroxide in inaccessible areas for Group 6 structures, stating that for inaccessible areas selection of concrete aggregates was per ASTM C33, which uses ASTM C227 and ASTM C295. Non-Class 1 concrete used the same nonreactive aggregates as Class 1 concrete. Also, inaccessible reinforced Class 1 concrete was constructed to ACI 211.1-74, which provides guidance similar to that of ACI 201.2R for concrete mix designs for high-density, low-permeability concrete. Non-Class 1 concrete in the auxiliary dam and spillway and main dam and spillway was not required per plant specifications to meet ACI 201.2R-77 water-cement ratios; therefore, inaccessible Non-Class 1 concrete at the auxiliary dam and spillway and main dam and spillway will be examined when excavated for any reason as addressed in the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program.

SRP-LR Section 3.5.2.2.2.4 states that cracking due to expansion and reaction with aggregates and increased porosity and permeability and loss of strength due to leaching of calcium hydroxide may occur in below-grade inaccessible reinforced concrete areas of Group 6 structures. The GALL Report recommends further evaluation of inaccessible areas for concrete not constructed in accordance within ACI 201.2R-77 recommendations.

The staff's audit and review found the GALL Report criteria satisfied and no further evaluation of any need for augmented or additional AMPs required for cracking due to expansion or to reaction with aggregates and increased porosity and permeability and loss of strength due to leaching of calcium hydroxide for below-grade inaccessible concrete areas of Class 1 Group 6 structures. The LRA states that concrete construction for below-grade inaccessible concrete areas of Class 1 Group 6 structures meets ACI 211.1-74 for concrete mix proportions similar to those of ACI 201.2R for high-density, low-permeability concrete mix designs. Although the Class 1 concrete water-cement ratio falls outside the listed range of 0.35 to 0.45 and the air content falls outside the 3 to 6 percent range (SER Section 3.5.2.2.2.2.1), within all parameters of concrete mix design, HNP concrete meets ACI quality requirements for acceptable concrete. In addition, the staff determined that the inaccessible concrete is not susceptible to cracking due to expansion from reaction with aggregates selected per ASTM C33, which uses ASTM C227 and ASTM C295. Such aggregates are not reactive. Non-Class 1 concrete has the same non-reactive aggregates as Class 1 concrete.

However, non-Class 1 concrete design for Group 6 structures was to requirements of ACI 318-71, ACI 301-72, and plant specifications. Subsequent inspections have found no degradation due to leaching of calcium hydroxide. Because the recommendations of ACI 201.2R-77 were not specified, inaccessible non-Class 1 concrete in the construction of Group 6 structures within the scope of license renewal will be examined whenever excavated for any reason under the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program. The staff finds the applicant adequately addressed further evaluation of this aging effect.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.4 criteria. For those line items that apply to LRA Section 3.5.2.2.2.4, 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).

Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.5.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.5.

LRA Section 3.5.2.2.2.5 addresses SCC and loss of material due to pitting and crevice corrosion, stating that these aging effects are not applicable because HNP has no tanks with stainless steel liners.

SRP-LR Section 3.5.2.2.2.5 states that SCC and loss of material due to pitting and crevice corrosion may occur in Groups 7 and 8 stainless steel tank liners exposed to standing water.

The staff determined through discussions with the applicant's technical personnel that SCC and loss of material due to pitting and crevice corrosion are not AERMs because there are no tanks with stainless steel liners in the structural AMRs. Tanks subject to an AMR are evaluated with their mechanical systems.

On the basis that HNP has no components from this group, the staff finds this aging effect not present.

Aging of Supports Not Covered by the Structures Monitoring Program

The staff reviewed LRA Section 3.5.2.2.2.6 against the criteria in SRP-LR Section 3.5.2.2.2.6.

LRA Section 3.5.2.2.2.6 addresses aging of supports not covered by the Structures Monitoring Program, stating that the GALL Report recommends further evaluation of aging effects for such component supports including (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 or loss of isolation function due to degradation of vibration isolation elements for Group B4 supports.

Unless the aging effect is not present, the Structures Monitoring Program manages degradation of supports for structures within the scope of license renewal except for the main dam and spillway managed instead by the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program, which visually inspects the concrete surfaces for deterioration and continuing serviceability and for structural cracking from overstress due to applied loads, shrinkage, temperature effects, or lateral movement. Both programs utilize ACI 349.3R-96 for concrete acceptance criteria; therefore, use of the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program is equivalent to use of the Structures Monitoring Program.

In accordance with GALL Report Volume 2, related Item T-31, no structure within the scope of license renewal utilizes vibration isolation elements; therefore, application of the Structures Monitoring Program is not required.

SRP-LR Section 3.5.2.2.2.6 states that the GALL Report recommends further evaluation of certain component support-aging effect combinations not covered by structures monitoring programs, including (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 applicant's Structures Monitoring Program.

The staff finds that the applicant includes the component aging effect or mechanism combinations loss of material due to general and pitting corrosion for Groups B2-B5 supports and reduction in concrete anchor capacity due to degradation of the surrounding concrete for Groups B1-B5 supports within the scope of its Structures Monitoring Program or its RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program. The staff determined that no further evaluation is required. The staff also determined through discussions with the applicant's technical personnel that reduction and loss of isolation function due to degradation of vibration isolation elements for Group B4 supports is not an AERM because there are no vibration isolation components within the scope of license renewal. The staff's evaluations of the applicant's Structures Monitoring Program and RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program are documented in SER Sections 3.0.3.2.24 and 3.0.3.2.25, respectively. The staff finds the applicant's Structures Monitoring Program and RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program acceptable for managing the aging effect or mechanism combinations for component support Groups B1 through B5.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.6 criteria. For those line items that apply to LRA Section 3.5.2.2.2.6, 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).

<u>Cumulative Fatigue Damage Due to Cyclic Loading</u>

LRA Section 3.5.2.2.2.7 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 is available.

There are no fatigue analyses in the CLB for component supports; therefore, cumulative fatigue damage of component supports is not a TLAA as defined in 10 CFR 54.3.

SRP-LR Section 3.5.2.2.2.7 states 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 with a CLB fatigue analysis. TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). If a TLAA is required, SER Section 4.3 documents the staff's review of the applicant's TLAA evaluation.

The staff determined through discussions with the applicant's technical personnel that there are no CLB fatigue analyses for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 and that cumulative fatigue damage cannot be evaluated as an aging effect for these components.

On the basis that HNP has no components from these groups with fatigue analyses, the staff finds that 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 applicant's QA program.

3.5.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.5.2-1 through 3.5.2-29, 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 3.5.2-29, 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.

3.5.2.3.1 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - containment building – LRA Table 3.5.2-1

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the containment building component groups.

LRA Table 3.5.2-1 states that carbon steel or stainless steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for these material and environment combinations; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 for mechanical systems apply to carbon steel and stainless steel mechanical piping and components embedded in concrete. These GALL Report Volume 2 line items document that there are no aging effects for these material and environment combinations. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel or stainless steel in concrete environments document that there are no aging effects for these material and environment combinations; therefore, the staff concludes that carbon steel or stainless steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-1 states that reinforced concrete for containment above grade-dome, wall, ring girder, and basemat components exposed to air-outdoor or air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter II, item II.A1-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that reinforced concrete for containment concrete above grade-dome, wall, ring girder, and basemat components exposed to air-outdoor or air-indoor environments exhibits no AERMs.

LRA Table 3.5.2-1 states that reinforced concrete for containment internal components exposed to containment air environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, items III.A4-1 and III.A5-1 set temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that reinforced concrete for containment internal components exposed to containment air environments exhibits no AERMs from elevated temperatures.

In LRA Table 3.5.2-1, the applicant proposed to manage change in material properties and cracking of reinforced concrete materials for containment internals (actual component is the primary shield wall) exposed to containment air environments with the Structures Monitoring

Program. The LRA states that the primary shield wall inside face is subject to 3.02E10 rads over 60 years, exceeding the criterion of 1E10 rads for no potential reinforced concrete aging effects. The staff determined through discussions with the applicant's technical personnel that reinforced concrete in an environment that does not exceed threshold values generally will perform as designed in radiation environments and therefore have no aging effect considered for license renewal; however, radiation exposure exceeding the threshold value can cause reduction of concrete strength.

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. The Structures Monitoring Program manages the aging effects of civil and structural commodities within the scope of license renewal. The program periodically inspects and monitors the condition of structures and structure component supports to detect and determine the extent of aging degradation leading to loss of intended functions. The program periodically visually inspects structural concrete for change in material properties and cracking from high-radiation environments. The program incorporates criteria recommended by INPO Good Practice Document 85-033, "Use of System Engineers;" NEI 96-03, "Guidelines for Monitoring the Condition of Structures at Nuclear Plants," and inspection guidance based on industry operating experience and recommendations from ACI Standard 349.3R-96, "Evaluation of Existing Nuclear Safety-Related Concrete Structures;" and ASCE 11-90, "Guideline for Structural Condition Assessment of Existing Buildings."

The staff determined through discussions with the applicant's technical personnel that the inside of the primary shield wall is normally inaccessible due to limited space between the wall and the reactor vessel and high radiation. The staff finds that the primary shield wall is designed for a minimum concrete compressive strength of 5000 psi required over the period of extended operation to support the reactor vessel, platforms, and pipe whip restraints. Based on the actual concrete test cylinder results from the concrete for the primary shield wall, the containment primary shield wall has more than sufficient design margin to account for any loss in compressive strength due to long-term exposure to radiation. Based on the applicant's analysis, aging management of the inside face of the primary shield wall concrete due to irradiation during the period of extended operation is not required because the primary shield wall concrete compressive strength will remain well above design and over-design strength (per ACI 359) even after experiencing irradiation. As noted, the inside face of the primary shield wall is inaccessible for normal visual inspections; however, the applicant stated during discussions with the staff that no indications of degradation (*e.g.*, cracking) have been observed. Visual inspection of the sump area just below the primary shield wall for concrete degradation with pictures taken of the primary shield wall concrete at the reactor vessel nozzle area found no concrete debris in the sump area to indicate degradation of the inaccessible primary shield wall above the sumpage The Structures Monitoring Program will inspect accessible concrete of the primary shield wall at least every 10 years. Degradation of accessible concrete would necessitate an evaluation of the inaccessible concrete.

On the basis of its review of primary shield wall concrete compressive strength and because these components will be inspected visually periodically, the staff found the aging effects change in material properties and cracking of reinforced concrete materials for containment internal (actual component is the primary shield wall) exposed to containment air environments effectively managed by the Structures Monitoring Program; however, the applicant has decided to change its evaluation for the need to manage these potential aging effects.

In its letter dated August 20, 2007, the applicant stated self-identified change amendments to the LRA. One such amendment stated that the projected 60-year gamma dose to the inside face of the primary shield wall was 1.29 E+10 Rads determined through a refined calculation completed after submission of the LRA; therefore, the following LRA changes/amendments are required:

Revise Plant-Specific Note 535 to read:

> The HNP AMR methodology concluded that there are no AERMs to the primary shield wall inside face due to irradiation. The primary shield wall inside face is subject to 1.29 E+10 Rads over 60 years.

On LRA Page 3.5-67, revise the line item for containment internal concrete and Note 535 to insert "None" in the columns for Aging Effect Requiring Management and Aging Management Program.

The staff finds the applicant now states that the primary shield wall inside face is subject to only 1.29E10 rads over 60 years instead of 3.02E10 rads as stated originally in the LRA; however, the revised value still exceeds the applicant's original criterion of 1E10 rads for no potential reinforced concrete aging effects. With the reduction in the calculated amount of radiation the primary shield wall concrete will experience over 60 years, the applicant now shows by amendment to LRA Table 3.5.2-1 that the shield wall concrete will experience no aging effects and require no AMP.

As stated in the original staff evaluation of this AMR line item, the staff determined through discussions with the applicant's technical personnel and the applicants analysis that aging management of the inside face of the primary shield wall concrete due to irradiation during the period of extended operation is not required because the primary shield wall concrete compressive strength will remain well above design and over-design strength (in accordance with ACI 359) even after experiencing irradiation. Also, the Structures Monitoring Program will inspect accessible concrete of the primary shield wall at least every 10 years. Degradation of accessible concrete would necessitate an evaluation of the inaccessible concrete, the component of concern under this AMR line item.

On the bases that the inside face of the primary shield wall will be exposed to much less radiation over 60 years than originally calculated with the concrete strength remaining above design requirements after the exposure and that the Structures Monitoring Program will inspect the primary shield wall accessible concrete, the staff finds the applicant's LRA Table 3.5.2-1 amendment stating that the AMR line item containment internal concrete (actual component is inaccessible concrete on the inside of the primary shield wall) exposed to containment air environments has no AERMs.

LRA Table 3.5.2-1 states that concrete for the (containment) foundation and subfoundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that concrete for the (containment) foundation and subfoundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-1 states that stainless steel expansion bellows components exposed to containment air environments exhibit no AERMs due to SCC. The applicant's AMR methodology concluded that stainless steel materials for penetration sleeves, penetration bellows, or expansion bellows have SCC aging effect. SCC of stainless steel in air affects only sensitized stainless steel exposed to intermittent wetting and aggressive environments. HNP containment building penetrations, including penetration sleeve (flued heads), bellows, and dissimilar metal welds, are not subject to intermittent wetting and aggressive environments. The expansion bellows between the reactor cavity and the fuel transfer tube is subject to periodic wetting during refueling outages but not to any aggressive environment. The fuel transfer tube is a Class 2 pipe assembly evaluated as a mechanical component with the refueling system. The staff finds that stainless steel expansion bellows components are not exposed to intermittent wetting and aggressive environments. The staff verified that the applicant evaluates the fuel transfer tube as a stainless steel mechanical component with the refueling system; therefore, the staff concludes that stainless steel expansion bellows components exposed to containment air environments exhibit no AERMs from SCC.

LRA Table 3.5.2-1 states that stainless steel expansion bellows components exposed to treated water environments exhibit no AERMs from SCC. The applicant stated that SCC is not an aging effect for this component because to be susceptible to SCC stainless steel must be subjected to both high temperature (greater than 140 °F) and aggressive chemical environments. The applicant's AMR methodology concluded that SCC is not an aging effect for this component because the temperature of the refueling water environment is maintained below 140 °F. The water temperature in the refueling pool cavity is also maintained below 140 °F during refueling operations. The staff finds the stainless steel expansion bellows components not exposed to high temperatures (greater than 140 °F) or aggressive environments; therefore, the staff concludes that stainless steel expansion bellows components exposed to treated water environments at HNP exhibit no AERMs from SCC.

LRA Table 3.5.2-1 states that fiberglass and hydrous calcium silicate insulation (hot piping penetrations) exposed to containment air environments have no AERMs. The applicant stated that the insulation is protected inside the penetration sleeves and that there never has been any aging effects noted for this component. Plant-specific operating experience shows no aging effects for this insulation component. On the basis of its review of industry research and plant operating experience, the staff concludes that fiberglass and hydrous calcium silicate insulation (hot piping penetration) exposed to containment air environments at HNP have no AERMs.

LRA Table 3.5.2-1 states that stainless steel penetration bellows components exposed to containment air environments exhibit no AERMs from SCC. The applicant's AMR methodology concluded that stainless steel materials for the penetration sleeves, penetration bellows, or expansion bellows exhibit no SCC as an aging effect. SCC of stainless steel in air affects only sensitized stainless steel exposed to intermittent wetting and aggressive environments. The containment building penetrations, including penetration sleeve (flued heads), bellows, and dissimilar metal welds, are not subject to intermittent wetting and aggressive environments. The staff finds the stainless steel penetration bellows components not exposed to intermittent wetting and aggressive environments; therefore, the staff concludes that such components exposed to containment air environments at HNP exhibit no AERMs from SCC.

LRA Table 3.5.2-1 states that stainless steel penetration sleeves exposed to containment air environments exhibit no AERMs from SCC. The applicant's AMR methodology concluded that stainless steel materials for the penetration sleeves, penetration bellows, or expansion bellows have no SCC as an aging effect. SCC of stainless steel in air affects only sensitized stainless steel exposed to intermittent wetting and aggressive environments. HNP containment building penetrations, including penetration sleeve (flued heads), bellows, and dissimilar metal welds, are not subject to intermittent wetting and aggressive environments. The staff finds that stainless steel penetration sleeves not exposed to intermittent wetting and aggressive environments; therefore, the staff concludes that stainless steel penetration sleeves exposed to containment air environments exhibit no AERMs from SCC.

LRA Table 3.5.2-1 states that carbon steel and stainless steel penetration sleeves exposed to containment air environments exhibit no AERMs from cumulative fatigue damage. The applicant stated that there is no fatigue analysis for the penetration sleeves in the CLB and that therefore cumulative fatigue damage is not an AERM for penetration sleeves. The staff finds no fatigue analysis for the penetration sleeves; therefore, the staff concludes that carbon steel and stainless steel penetration sleeves exposed to containment air environments exhibit no AERMs from cumulative fatigue damage.

LRA Table 3.5.2-1 states that copper penetration sleeves (cooling fins on the mainsteam and feedwater penetrations) exposed to containment air or borated water leakage environments have no AERMs. The applicant stated during discussions that the copper is resistant to corrosion aging effects because of low zinc (less than 15 percent) and aluminum (less than 8 percent) contents and that there is no MIC source; therefore, the staff concludes that copper penetration sleeves (cooling fins on the mainsteam and feedwater penetrations) exposed to containment air or borated water leakage environments have no AERMs.

LRA Table 3.5.2-1 states that stainless steel fuel pool liner (including attachments) components exposed to treated water environments exhibit no AERMs from SCC. The applicant stated that SCC is not an aging effect for these component because to be susceptible stainless steel must be subjected to both high temperature (greater than 140 °F) and aggressive chemical environments. The applicant's AMR methodology concluded that SCC is not an aging effect for these components because the refueling water environment temperature is maintained below 140 °F. The water temperature in the refueling pool cavity is also maintained below 140 °F during refueling operations. The staff finds the stainless steel fuel pool liner (including attachments) components not exposed to high temperatures (greater than 140 °F) or aggressive environments; therefore, the staff concludes that such components exposed to treated water environments exhibit no AERMs from SCC.

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).

3.5.2.3.2 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Reactor Auxiliary 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 auxiliary building component groups.

LRA Table 3.5.2-2 states that carbon steel or stainless steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for these material and environment combinations; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 for mechanical systems for carbon steel and stainless steel mechanical piping and components embedded in concrete items document that there are no aging effects for these material and environment combinations. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel or stainless steel in concrete environments document that there are no aging effects for these material and environment combinations; therefore, the staff concludes that carbon steel or stainless steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-2 states that reinforced concrete for the (reactor auxiliary building) foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundations; therefore, the staff concludes that reinforced concrete for the (reactor auxiliary building) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-2 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

LRA Table 3.5.2-2 states that incombustible mineral fiber control room ceiling components exposed to air-indoor environments have no AERMs. The applicant stated in discussions with the staff that there is no industry operating experience showing that incombustible mineral fiber boards exposed to air-indoor environments have any AERMs. The boards at HNP are in a temperature and humidity controlled area (although not credited for license renewal); as such, components within that environment are not exposed to the mechanisms and effects required to propagate component degradation. The applicant stated that plant-specific operating experience for the control room area shows no aging effects for mineral board fibers.

The staff review of plant-specific operating experience found no aging effects for incombustible mineral fiber boards. On the basis of its review of industry research and plant-specific operating experience, the staff concludes that incombustible mineral fiber boards exposed to air-indoor environments have no AERMs.

In LRA Table 3.5.2-2, the applicant proposed to manage loss of material and cracking of fireproofing materials for fire barrier assemblies exposed to air-indoor environments with the Fire Protection Program. The LRA states that fire barrier component types include thermo lag walls, gypsum board walls, cable fire wraps, and cable tray breaks. The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.10. This program manages aging of the diesel-driven fire pump fuel oil supply line and fire barrier assemblies including fire doors, penetration seals, fire wrap, barrier ceilings and floors, and seismic joint filler. The program periodically visually inspects fire doors, penetration seals, fire wrap, barrier ceilings and floors, and seismic joint filler for any sign of degradation (*e.g.*, cracking, spalling, and loss of material). On the basis of its review and because these components will be inspected visually periodically, the staff finds the aging effects loss of material and cracking of fire proofing materials for fire barrier assemblies exposed to air-indoor environments effectively managed by the Fire Protection Program.

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).

3.5.2.3.3 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Auxiliary Reservoir Channel – LRA Table 3.5.2-3

The staff reviewed LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the auxiliary reservoir channel component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.4 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Auxiliary Dam and Spillway – LRA Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the auxiliary dam and spillway component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.5 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Auxiliary Reservoir – LRA Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the auxiliary reservoir component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.6 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Auxiliary Reservoir Separating Dike – LRA Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the auxiliary reservoir separating dike component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.7 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Cooling Tower – LRA Table 3.5.2-7

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the cooling tower component groups.

LRA Table 3.5.2-7 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 for mechanical systems document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-7 states that reinforced concrete for the (cooling tower) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (cooling tower) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

In LRA Table 3.5.2-7, the applicant proposed to manage loss of material, cracking, and change in material properties of reinforced concrete and asbestos cement pipe exposed to air-outdoor environments with the External Surfaces Monitoring Program. The applicant's AMR methodology determined that reinforced concrete and asbestos cement pipe in air-outdoor environments have the same aging effects as structural concrete; however, the applicant selected a mechanical AMP to mange the aging effects.

The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. This program, based on system inspections and walkdowns, periodically visually inspects components (*e.g.*, piping, piping components, ducting) and other equipment within the scope of license renewal and subject to an AMR. The program manages aging effects (*e.g.*, loss of material, cracking, and change in material properties) through visual inspection of external surfaces. On the basis of its review and because this component will be visually inspected periodically, the staff finds the aging effects loss of material, cracking, and change in material properties of reinforced concrete and asbestos cement pipe exposed to air-outdoor environments effectively managed by the External Surfaces Monitoring Program.

In LRA Table 3.5.2-7, the applicant proposed to manage loss of material, cracking, and change in material properties of reinforced concrete and asbestos cement pipe exposed to raw water environments with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant's AMR methodology determined that reinforced concrete and asbestos cement pipe in raw water environments have the same aging effects as structural concrete; however, the applicant selected a mechanical AMP to mange the aging effects.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. This new program will implement existing predictive maintenance, preventive maintenance, surveillance testing, and periodic testing work order tasks as opportunities for visual inspection of internal surfaces of piping, piping elements, ducting, and components. Periodic internal inspections of components timely detect component degradation and determine appropriate corrective actions. The program work activities will monitor parameters that may be detected by visual inspection: change in material properties, cracking, flow blockage, loss of material, and reduction of heat transfer effectiveness. The extent and schedule of inspections and testing assure detection of component degradation prior to loss of intended functions. On the basis of its review and because this component will be visually inspected periodically, the staff finds the aging effects loss of material, cracking, and change in material properties of reinforced concrete and asbestos cement pipe exposed to raw water environments effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

LRA Table 3.5.2-7 states that stainless steel supports for non-ASME piping and components exposed to air-outdoor environments have no AERMs. During the audit and review, the staff noted that in LRA Table 3.5.2-7 on page 3.5-95 for AMR component supports for non-ASME piping and components, material stainless steel in air-outdoor environments, Note 573 states: "The AMR methodology concluded that stainless steel in the air-outdoor environment has no aging effect." The staff asked the applicant for the AMR methodology substantiating this conclusion. The applicant stated that the methodology is substantiated in the license renewal basis calculations and based on industry aging effects tools for structural and mechanical component materials. In summary, the air-outdoor environment at HNP is subject to normal periodic wetting but not to aggressive mechanisms from any nearby industrial facility or salt water source which could concentrate contaminates and cause aging effects for stainless steel. In addition, no plant-specific operating experience shows aging effects for stainless steel in the air-outdoor environment. On the basis of plant-specific operating experience, the staff concludes that stainless steel supports for non-ASME piping and components exposed to air-outdoor environments have no AERMs.

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).

3.5.2.3.8 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Cooling Tower Makeup Water Intake Channel – LRA Table 3.5.2-8

The staff reviewed LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the cooling tower makeup water intake channel component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.9 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Circulating Water Intake Structure – LRA Table 3.5.2-9

The staff reviewed LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the circulating water intake structure component groups.

LRA Table 3.5.2-9 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 for mechanical systems document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-9 states that reinforced concrete for the (circulating water intake structure) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (circulating water intake structure) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

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).

3.5.2.3.10 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Diesel Generator Building – LRA Table 3.5.2-10

The staff reviewed LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the diesel generator building component groups.

LRA Table 3.5.2-10 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-10 states that reinforced concrete for the (diesel generator building) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (diesel generator building) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-10 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

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).

3.5.2.3.11 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Main Dam and Spillway – LRA Table 3.5.2-11

The staff reviewed LRA Table 3.5.2-11, which summarizes the results of AMR evaluations for the main dam and spillway component groups.

LRA Table 3.5.2-11 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

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).

3.5.2.3.12 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - diesel fuel oil storage tank building – LRA Table 3.5.2-12

The staff reviewed LRA Table 3.5.2-12, which summarizes the results of AMR evaluations for the diesel fuel oil storage tank building component groups.

LRA Table 3.5.2-12 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-12 states that reinforced concrete for the (diesel fuel oil storage tank building) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (diesel fuel oil storage tank building) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

In LRA Table 3.5.2-12, the applicant proposed to manage loss of material and cracking of fireproofing materials for fire barrier assemblies exposed to air-indoor environments with the Fire Protection Program. The LRA states that fire barrier component types include thermo lag walls, gypsum board walls, cable fire wraps, and cable tray breaks.

The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.10. The Fire Protection Program manages aging of the diesel-driven fire pump fuel oil supply line and fire barrier assemblies including fire doors, penetration seals, fire wrap, barrier ceilings and floors, and seismic joint filler. The program periodically visually inspects fire doors, penetration seals, fire wrap, barrier ceilings and floors, and seismic joint filler for any sign of degradation (*e.g.*, cracking, spalling, and loss of material). On the basis of its review and because these components will be inspected visually periodically, the staff finds the aging effects loss of material and cracking of fireproofing materials for fire barrier assemblies exposed to air-indoor environments effectively managed by the Fire Protection Program.

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).

3.5.2.3.13 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Emergency Service Water and Cooling Tower Makeup Intake Structure – LRA Table 3.5.2-13

The staff reviewed LRA Table 3.5.2-13, which summarizes the results of AMR evaluations for the emergency service water and cooling tower makeup intake structure component groups.

LRA Table 3.5.2-13 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-13 states that reinforced concrete for the (emergency service water and cooling tower makeup intake structure) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (emergency service water and cooling tower makeup intake structure) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

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).

3.5.2.3.14 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Emergency Service Water Discharge Channel – LRA Table 3.5.2-14

The staff reviewed LRA Table 3.5.2-14, which summarizes the results of AMR evaluations for the emergency service water discharge channel component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.15 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Emergency Service Water Discharge Structure – LRA Table 3.5.2-15

The staff reviewed LRA Table 3.5.2-15, which summarizes the results of AMR evaluations for the emergency service water discharge structure component groups.

LRA Table 3.5.2-15 states that reinforced concrete for the (emergency service water discharge structure) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation;

therefore, the staff concludes that reinforced concrete for the (emergency service water discharge structure) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

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).

3.5.2.3.16 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Emergency Service Water Intake Channel – LRA Table 3.5.2-16

The staff reviewed LRA Table 3.5.2-16, which summarizes the results of AMR evaluations for the emergency service water intake channel component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.17 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - fuel handling building – LRA Table 3.5.2-17

The staff reviewed LRA Table 3.5.2-17, which summarizes the results of AMR evaluations for the fuel handling building component groups.

LRA Table 3.5.2-17 states that carbon steel or stainless steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for these material and environment combinations; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for these material and environment combinations. The staff finds that these GALL Report Volume 2 line items for mechanical systems with carbon steel or stainless steel in a concrete environment document that there are no aging effects for these material and environment combinations; therefore, the staff concludes that carbon steel or stainless steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-17 states that stainless steel canal and pool gate components exposed to treated water environments exhibit no AERMs from SCC. The applicant stated that SCC is not an aging effect for these component because to be susceptible stainless steel must be subjected to both high temperature (greater than 140 °F) and aggressive chemical environments. The applicant's AMR methodology concluded that SCC is not an aging effect for these components because the temperature of the fuel pool water is maintained below 140 °F (normally between 105 °F and 126 °F). During fuel shuffle and offloads, administrative controls maintain spent fuel pool temperature at less than or equal to 140 °F. The staff finds that the stainless steel canal and pool gate components are not exposed to high temperatures (greater than 140 °F) or an aggressive environments; therefore, the staff concludes that such components exposed to treated water environments exhibit no AERMs from SCC.

LRA Table 3.5.2-17 states that reinforced concrete for the (fuel handling building) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (fuel handling building) concrete foundation exposed to soil environments exhibits no aging effects from a porous concrete subfoundation.

During the audit and review, the staff noted that in LRA Table 3.5.2-17 on page 3.5-132 for AMR component concrete interior, material reinforced concrete in air-indoor environments, aging effect change in material properties, Table 1, item 3.5.1-33, Note I states: "Aging effect in the GALL Report for this component, material and environment combination is not present," and Note 502 states: "Change in material properties due to elevated temperature is not an aging effect because the concrete is not subject to general area temperature greater than 150 °F or local area temperatures greater than 200 °F." The staff asked the applicant to explain why Notes I and 502 state no aging effects with the aging effect change in material properties with AMP Structures Monitoring shown for this Table 2 AMR line item.

In its letter dated August 20, 2007, the applicant stated the temperature range for the fuel handling building is 60 °F to 115.5 °F. Note 502 states that there are no aging effects due to elevated temperature for this building and Notes I and 502 for this line item are correct; however, the AERM and AMPs should be "None."

On the basis of this response, the LRA and the license renewal basis calculation will be amended to change the AERM and the AMP column items to "None" for LRA Table 3.5.2-17 on page 3.5-132 for AMR component concrete interior, material reinforced concrete in air-indoor environments.

In the same August 20, 2007 letter, the applicant amended the aging effect and AMP for this AMR line item to "None" in LRA Table 3.5.2-17.

LRA Table 3.5.2-17 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A5-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

LRA Table 3.5.2-17 states that stainless steel expansion bellows exposed to treated water environments exhibit no AERMs from SCC. The applicant stated that SCC is not an aging effect for these component because to be susceptible stainless steel must be subjected to both high temperatures (greater than 140 °F) and aggressive chemical environments. The applicant's AMR methodology concluded that SCC is not an aging effect for these components because the temperature of the fuel pool water is maintained below 140 °F (normally between 105 °F and 126 °F). During fuel shuffle and offloads, administrative controls maintain the spent fuel pool temperature at less than or equal to 140 °F. The staff finds the stainless steel expansion bellows not exposed to high temperatures (greater than 140 °F) or aggressive environments;

therefore, the staff concludes that stainless steel expansion bellows exposed to treated water environments exhibit no AERMs from SCC.

In LRA Table 3.5.2-17, the applicant proposed to manage loss of material and cracking of fireproofing materials for fire barrier assemblies exposed to air-indoor environments with the Fire Protection Program. The LRA states that fire barrier component types include thermo lag walls, gypsum board walls, cable fire wraps, and cable tray breaks.

The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.10. This program manages aging of the diesel-driven fire pump fuel oil supply line and fire barrier assemblies including fire doors, penetration seals, fire wrap, barrier ceilings and floors, and seismic joint filler. The program periodically visually inspects fire doors, penetration seals, fire wrap, barrier ceilings and floors, and seismic joint filler for any sign of degradation (*e.g.*, cracking, spalling, and loss of material). On the basis of its review and because these components will be inspected visually periodically, the staff finds the aging effects loss of material and cracking of fireproofing materials for fire barrier assemblies exposed to air-indoor environments effectively managed by the Fire Protection Program.

LRA Table 3.5.2-17 states that stainless steel fuel pool liner (including attachments) components exposed to treated water environments exhibit no AERMs from SCC. The applicant stated that SCC is not an aging effect for these component because to be susceptible stainless steel must be subjected to both high temperatures (greater than 140 °F) and aggressive chemical environments. The applicant's AMR methodology concluded that SCC is not an aging effect for these components because the temperature of the fuel pool water is maintained below 140 °F (normally between 105 °F and 126 °F). During fuel shuffle and offloads, administrative controls maintain the spent fuel pool temperature at less than or equal to 140 °F. The staff finds stainless steel fuel pool liner (including attachments) components not exposed to high temperatures (greater than 140 °F) or aggressive environments; therefore, the staff concludes that such components exposed to treated water environments exhibit no AERMs from SCC.

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).

3.5.2.3.18 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - HVAC Equipment Room – LRA Table 3.5.2-18

The staff reviewed LRA Table 3.5.2-18, which summarizes the results of AMR evaluations for the HVAC equipment room component groups.

LRA Table 3.5.2-18 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-18 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

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).

3.5.2.3.19 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Outside The Power Block Structures – LRA Table 3.5.2-19

The staff reviewed LRA Table 3.5.2-19, which summarizes the results of AMR evaluations for the outside the power block structures component groups.

LRA Table 3.5.2-19 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-19 states that reinforced concrete for the (outside the power block structures) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (outside the power block structures) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-19 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

In LRA Table 3.5.2-19, the applicant proposed to manage loss of material of carbon steel platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures (including support members, welds, bolted connections, support anchorages to building structures) exposed to soil environments with the One-time Inspection Program. The LRA states that the actual components in this AMR line item are the tie-rods that hold the fuel-handling building retaining wall in place. The tie-rods are buried in soil and therefore inaccessible. Periodic monitoring of the tie-rods on three occasions during the current 40-year licensing period by way of retrievable tie-rod specimens located in the same environment recorded no adverse plant-specific operating experience for the tie-rods. Currently, there are no remaining test specimens available for monitoring. For the purpose of the AMR, the tie-rods were a miscellaneous structure with no credit taken for their epoxy coating. The AMR determined that the tie-rods have an aging effect of loss of material due to various mechanisms although specially epoxy-coated at the time of installation. Removal and examination of test specimens (at 5, 10, and 15 years per FSAR 3.8.4-42) in the same soil environment found no detrimental corrosion; therefore, based on the positive test results, the conclusion is that there should be a one-time inspection of the upper-most tie-rods just prior to the period of extended operation, within two years of 2026, to determine whether the tie-rod coatings have degradation that could prevent performance of their function.

The staff's evaluation of the One-time Inspection Program is documented in SER Section 3.0.3.1.5. The One-Time Inspection Program verifies the effectiveness of an AMP and confirms the absence of an aging effect. The program includes inspections specified by the GALL Report as well as plant-specific inspections where results can be extrapolated reasonably through the period of extended operation. Visual and volumetric inspections of the retaining wall buried tie-rods for loss of material are in the One-Time Inspection Program. On the basis of its review and because these components have experienced no detrimental corrosion and will be sample-inspected within two years of the period of extended operation, the staff finds the aging effects loss of material of carbon steel tie-rods exposed to soil environments effectively managed by the One-time Inspection Program.

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).

3.5.2.3.20 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Main Reservoir – LRA Table 3.5.2-20

The staff reviewed LRA Table 3.5.2-20, which summarizes the results of AMR evaluations for the main reservoir component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.21 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Security Building – LRA Table 3.5.2-21

The staff reviewed LRA Table 3.5.2-21, which summarizes the results of AMR evaluations for the security building component groups.

LRA Table 3.5.2-21 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-21 states that reinforced concrete for the (security building) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (security building) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-21 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

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).

3.5.2.3.22 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Emergency Service Water Screening Structure – LRA Table 3.5.2-22

The staff reviewed LRA Table 3.5.2-22, which summarizes the results of AMR evaluations for the emergency service water screening structure component groups.

LRA Table 3.5.2-22 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in concrete environments document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-22 states that reinforced concrete for the (emergency service water screening structure) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (emergency service water screening structure) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-22 states that stainless steel racks, panels, cabinets, and enclosures for electrical equipment and instrumentation (includes support members, welds, bolted connections, support anchorages to building structures) exposed to air-outdoor environments have no AERMs. During the audit and review, the staff noted that for this AMR line item, Note 573 states: "The HNP AMR methodology concluded that stainless steel in the air-outdoor environment has no aging effect." The staff asked the applicant for the AMR methodology substantiating this conclusion. The applicant stated that the methodology in the license renewal basis calculations is based on industry aging effects tools for structural and mechanical component materials. In summary, the air-outdoor environment at HNP is subject to normal periodic wetting but not exposed to aggressive environments from any nearby industrial facility or salt water which could concentrate contaminates and cause aging effects for stainless steel. In addition, no plant-specific operating experience shows aging effects for stainless steel in the air-outdoor environment. On the basis of plant-specific operating experience, the staff concludes that stainless steel racks, panels, cabinets, and enclosures for electrical equipment and instrumentation (includes support members, welds, bolted connections, support anchorages to building structures) exposed to air-outdoor environments have no AERMs.

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).

3.5.2.3.23 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Normal Service Water Intake Structure – LRA Table 3.5.2-23

The staff reviewed LRA Table 3.5.2-23, which summarizes the results of AMR evaluations for the normal service water intake structure component groups.

LRA Table 3.5.2-23 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-23 states that reinforced concrete for the (normal service water intake structure) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (normal service water intake structure) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

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).

3.5.2.3.24 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Switchyard Relay Building – LRA Table 3.5.2-24

The staff reviewed LRA Table 3.5.2-24, which summarizes the results of AMR evaluations for the switchyard relay building component groups.

LRA Table 3.5.2-24 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-24 states that reinforced concrete for the (switchyard relay building) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (switchyard relay building) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation requiring management.

LRA Table 3.5.2-24 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

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).

3.5.2.3.25 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Transformer and Switchyard Structures – LRA Table 3.5.2-25

The staff reviewed LRA Table 3.5.2-25, which summarizes the results of AMR evaluations for the transformer and switchyard structures component groups.

LRA Table 3.5.2-25 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-25 states that PVC cable tray, conduit, HVAC duct, and tube track (includes support members, welds, bolted connections, support anchorages to building structures) components exposed to concrete environments have no AERMs. The applicant stated in discussions with the staff that the industry product data indicate excellent PVC resistance to nearly all acids, caustics, salt solutions, and other corrosive liquids. PVC has become one of the most popular materials for underground (soil) applications. Additionally, it has specialized use for concrete encasement applications. The applicant stated that plant-specific operating experience for the transformer and switchyard structures shows no aging effects for PVC and no adverse effects for either of these applications were apparent from industry reports. The staff review of plant-specific operating experience found no aging effects for PVC materials. On the basis of its review of industry research and plant-specific operating experience, the staff concludes that PVC cable tray, conduit, HVAC duct, and tube track (includes support members, welds, bolted connections, support anchorages to building structures) components exposed to concrete environments have no AERMs.

In LRA Table 3.5.2-25, the applicant proposed to manage loss of material and change in material properties of wood cable tray, conduit, HVAC duct, and tube track (includes support members, welds, bolted connections, support anchorages to building structures) components exposed to air-outdoor environments with the Structures Monitoring Program. The LRA states that the actual component in this AMR line item is a wood support to the oil-filled cable in the switchyard and transformer yard.

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. This program manages the aging effects of civil/structural commodities within the scope of license renewal by periodically inspecting and monitoring the condition of structures and structure component supports to detect and determine the extent of aging degradation leading to loss of intended functions. The program periodically visually inspects structural wood members for loss of material and change in material properties from decay or insect infestation. On the basis of its review and because these components will be inspected visually periodically, the staff finds the aging effects loss of material and change in material properties of wood supports exposed to air-outdoor environments effectively managed by the Structures Monitoring Program.

LRA Table 3.5.2-25 states that reinforced concrete for the (transformer and switchyard structures) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (transformer and switchyard structures) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-25 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

LRA Table 3.5.2-25 states that stainless steel phase bus enclosure assemblies exposed to air-outdoor environments have no AERMs. During the audit and review, the staff noted that for this AMR line item, Note 573 states: "The HNP AMR methodology concluded that stainless steel in the air-outdoor environment has no aging effect." The staff asked the applicant for the HNP AMR methodology substantiating this conclusion. The applicant stated that the HNP methodology in the license renewal basis calculations is based on industry aging effects tools for structural and mechanical component materials. In summary, the air-outdoor environment at

HNP is subject to normal periodic wetting but not to an aggressive environment from any nearby industrial facility or salt water which could concentrate contaminates and cause aging effects for stainless steel. In addition, no plant-specific operating experience shows aging effects for stainless steel in air-outdoor environments. On the basis of plant-specific operating experience, the staff concludes that stainless steel phase bus enclosure assemblies exposed to air-outdoor environments have no AERMs.

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).

3.5.2.3.26 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Turbine Building – LRA Table 3.5.2-26

The staff reviewed LRA Table 3.5.2-26, which summarizes the results of AMR evaluations for the turbine building component groups.

LRA Table 3.5.2-26 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-26 states that reinforced concrete for the (turbine building) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (turbine building) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-26 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

LRA Table 3.5.2-26 states that stainless steel platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures (includes support members, welds, bolted connections, support anchorage to building structure) exposed to air-outdoor environments have no AERMs. During the audit and review, the staff noted that for this AMR line item, Note 573 states: "The HNP AMR methodology concluded that stainless steel in the air-outdoor environment has no aging effect." The staff asked the applicant for the HNP AMR methodology substantiating this conclusion. The applicant stated that the HNP methodology in the license renewal basis calculations is based on industry aging effects tools for structural and mechanical component materials. In summary, the air-outdoor environment at HNP is subject to normal periodic wetting but not to an aggressive environment from any nearby industrial facility or salt water which could concentrate contaminates and cause aging effects for stainless steel. In addition, no plant-specific operating experience shows aging effects for stainless steel in air-outdoor environments. On the basis of plant-specific operating experience, the staff concludes that stainless steel platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures (includes support members, welds, bolted connections, support anchorages to building structures) exposed to air-outdoor environments have no AERMs.

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).

3.5.2.3.27 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Tank Area/Building – LRA Table 3.5.2-27

The staff reviewed LRA Table 3.5.2-27, which summarizes the results of AMR evaluations for the tank area/building component groups.

LRA Table 3.5.2-27 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-27 states that reinforced concrete for the (tank area/building) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (tank area/building) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

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).

3.5.2.3.28 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Waste Processing Building – LRA Table 3.5.2-28

The staff reviewed LRA Table 3.5.2-28, which summarizes the results of AMR evaluations for the waste processing building component groups.

LRA Table 3.5.2-28 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

LRA Table 3.5.2-28 states that reinforced concrete for the (waste processing building) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (waste processing building) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-28 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

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).

3.5.2.3.29 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Yard Structures – LRA Table 3.5.2-29

The staff reviewed LRA Table 3.5.2-29, which summarizes the results of AMR evaluations for the yard structures component groups.

LRA Table 3.5.2-29 states that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs. There is no corresponding GALL Report Table 1 line item or GALL Report Volume 2 Chapter II or III line item for this material and environment combination; however, GALL Report Volume 2 line items RP-01, RP-06, EP-5, EP-20, SP-2, SP-13 and AP-19 document that there are no aging effects for this material and environment combination. The staff finds that the GALL Report Volume 2 line items for mechanical systems with carbon steel in a concrete environment document that there are no aging effects for this material and environment combination; therefore, the staff concludes that carbon steel anchorage/embedment components exposed to concrete environments have no AERMs.

During the audit and review, the staff noted that in LRA Table 3.5.2-29 on page 3.5-192 for AMR component cable tray, conduit etc., material stainless steel and carbon steel, Note 555 states: "Buried conduits that connect to Class 1 manholes have a designed water tight clamping arrangement." The staff asked the applicant for a drawing showing the water-tight clamping arrangement with the components shown. In LRA Table 3.5.2-29 on page 3.5-197 for AMR component seals and gaskets, material elastomer in a soil environment, Note 555 states: "The HNP AMR methodology concluded that the neoprene boot material has no aging effect in soil, etc." The staff asked the applicant for the HNP AMR methodology substantiating this conclusion.

In its letter dated August 20, 2007, the applicant stated the water-tight clamping arrangement for the manholes is shown on FSAR Figure 3.8.4-23 and is available at HNP for review. The HNP AMR methodology for concluding that neoprene boot material has no aging effect in soil in the AMR license renewal basis calculation is based on industry aging effects tools for structural and mechanical component materials.

However, in LRA Table 3.5.2-29 on page 3.5-192 for AMR component cable tray, conduit, etc., material stainless steel and carbon steel, the Structures Monitoring Program will be deleted and "None" inserted because there is no direct visual inspection of the stainless steel clamp or carbon steel closure plate in the soil environment. In addition Note 555 will be revised to clarify that water intrusion through the area where the buried conduits connect to the Class I manholes will be detected from inspections inside the manholes under the commodity interior concrete by the Structures Monitoring Program.

On the basis of this response, the LRA will be amended in Table 3.5.2-29 on page 3.5-192 for AMR component cable tray, conduit etc., material stainless steel and carbon steel in a soil environment to delete the Structures Monitoring Program and insert "None." In addition Note 555 will be revised as follows:

> 'Buried conduits that connect to Class 1 manholes have a designed water tight clamping arrangement. The clamping arrangement provided includes a carbon steel support structure, stainless steel clamps, and a neoprene boot. The purpose of the clamping arrangement is to prevent water intrusion into the manholes.' Due to the inaccessible location of the arrangement and potential damage to the safety-related cable, no direct visual inspection is planned for the buried clamping arrangement in the soil; however, degradation of the clamping arrangement leading to water intrusion into the manholes can be determined from inspections performed from inside the manhole. The interior of

the manholes (included with commodity, concrete: interior) will continue to be inspected by the Structures Monitoring Program for water intrusion, including the area where the buried conduits connect to the Class I manholes.

The HNP AMR methodology concluded that the neoprene boot material has no aging effect in soil and that carbon steel and stainless steel in soil have the aging effect of loss of material.

In the same August 20, 2007 letter, the applicant amended the AMP to "None" for the LRA Table 3.5.2-29 AMR line item and also revised Note 555 accordingly.

Based on the applicant's response, in LRA Table 3.5.2-29 on page 3.5-192, for AMR components cable trays, conduits, HVAC ducts, tube tracks (includes support members, welds, bolted connections, support anchorage to building structure), materials carbon steel and stainless steel, environment soil, aging effect loss of material the AMP for both materials is none. The staff finds based on discussions with the applicant that buried conduits that connect to Class 1 manholes have a designed water-tight clamping arrangement with a carbon steel support structure, stainless steel clamps, and a neoprene boot to prevent water intrusion into the manholes; therefore, the staff concludes that, due to the inaccessible location of the buried clamping arrangement, no direct visual inspection is planned and loss of material for these carbon steel and stainless steel components will not be managed directly by an AMP; however, degradation of the clamping arrangement leading to water intrusion into the manholes can be determined from inspections inside the manhole. The interior of the manholes (included under the component interior concrete) will be inspected by the Structures Monitoring Program for water intrusion, including the area where the buried conduits connect to the Class I manholes. Use of the Structures Monitoring Program to inspect manhole interiors is consistent with the GALL Report.

LRA Table 3.5.2-29 states that PVC/PVC-coated conduit, steel cable tray, HVAC duct, and tube track (includes support members, welds, bolted connections, support anchorages to building structures) components exposed to soil environments have no AERMs. The applicant stated in discussions with the staff that the industry product data indicates excellent PVC resistance to nearly all acids, caustics, salt solutions and other corrosive liquids. PVC has become one of the most popular materials for underground (soil) applications. The applicant stated that plant-specific operating experience for the yard structures has shows no aging effects for with PVC and no adverse effects for this application apparent from industry reports. Plant-specific operating experience shows no aging effects for PVC/PVC-coated materials. On the basis of industry research and plant-specific operating experience, the staff concludes that PVC/PVC-coated cable tray, conduit, HVAC duct, and tube track (includes support members, welds, bolted connections, support anchorages to building structures) components exposed to soil environments have no AERMs.

LRA Table 3.5.2-29 states that reinforced concrete for the (yard structures) concrete foundation exposed to soil environments exhibits no aging effects from erosion of a porous concrete subfoundation. HNP has no porous concrete subfoundation; therefore, the staff concludes that reinforced concrete for the (yard structures) concrete foundation exposed to soil environments exhibits no AERMs from a porous concrete subfoundation.

LRA Table 3.5.2-29 states that interior reinforced concrete exposed to air-indoor environments exhibits no aging effects from elevated temperatures. GALL Report Volume 2 Chapter III, item III.A3-1 sets temperature limits for when reinforced concrete exhibits aging effects. Based on the GALL Report temperatures, change in material properties of reinforced concrete due to elevated temperature is not an aging effect for these components because the concrete is not subject to general area temperatures greater than 150 °F or local area temperatures greater than 200 °F; therefore, the staff concludes that interior reinforced concrete exposed to air-indoor environments exhibits no AERMs from elevated temperatures.

In LRA Table 3.5.2-29, the applicant proposed to manage loss of material, cracking, and change in material properties of reinforced concrete pipe exposed to raw water environments with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant's AMR methodology determined that reinforced concrete pipe in a raw water environment has the same aging effects as structural concrete; however, the applicant selected a mechanical AMP to mange the aging effects.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.7. This new program will implement existing predictive maintenance, preventive maintenance, surveillance testing, and periodic testing work order tasks for opportunities for periodic visual inspection of internal surfaces of piping, piping elements, ducting,, and components for timely detection of component degradation and determination of appropriate corrective actions. The program work activities will monitor parameters that may be detected by visual inspection, including change in material properties, cracking, flow blockage, loss of material, and reduction of heat transfer effectiveness. The extent and schedule of inspections and testing assure detection of component degradation prior to loss of intended functions. On the basis of its review and because this component will be visually inspected periodically, the staff finds the aging effects loss of material, cracking, and change in material properties of reinforced concrete pipe exposed to raw water environments effectively managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

During the audit and review, the staff noted that in LRA Table 3.5.2-29 on page 3.5-196 for AMR component pipe, material reinforced concrete, environment soil, aging effects cracking, loss of material, and change in material properties the AMP is Buried Piping and Tanks Inspection Program. A review of this program shows that inspection of buried reinforced concrete pipe is not part of it. The staff asked the applicant to explain why the Buried Piping and Tanks Inspection Program is shown for this line item to manage the aging effects when the component reinforced concrete pipe is not within the scope of the program.

In its letter dated August 20, 2007, the applicant stated the LRA inadvertently did not incorporate a license renewal basis calculation change into LRA Table 3.5.2-29. LRA Table 3.5.2-29 should be revised as follows:

> LRA Table 3.5.2-29 on page 3.5-196 for AMR component pipe, material reinforced concrete, in a soil environment, the Buried Piping and Tanks Inspection Program should be deleted and replaced with the Structures Monitoring Program. In addition Note 547 should be revised as follows:

> The reinforced concrete pipe and asbestos cement manifold header are mechanical components utilizing civil materials which do not align with the GALL Report. The HNP AMR methodology concluded that reinforced concrete and asbestos cement pipe in raw water and air-outdoor environments and reinforced concrete pipe in a soil environment have the same aging effects as structural concrete. The Structures Monitoring Program was selected to manage the aging effects of reinforced concrete pipe in a soil environment and mechanical AMPs were selected to manage the aging effects of reinforced concrete and asbestos cement pipe in raw water and air-outdoor environments.

On the basis of this response, LRA Table 3.5.2-29 on page 3.5-196 will be amended for AMR component pipe, material reinforced concrete, soil environment to delete the Buried Piping and Tanks Inspection Program and insert the Structures Monitoring Program. In addition Note 547 on LRA page 3.5-202 will be amended as follows:

> The reinforced concrete pipe and asbestos cement manifold header are mechanical components utilizing civil materials which do not align with the GALL Report. The HNP AMR methodology concluded that reinforced concrete and asbestos cement pipe in raw water and air-outdoor environments and reinforced concrete pipe in a soil environment have the same aging effects as structural concrete. The Structures Monitoring Program was selected to manage the aging effects of reinforced concrete pipe in a soil environment and mechanical AMPs were selected to manage the aging effects of reinforced concrete and asbestos cement pipe in raw water and air-outdoor environments.

In the same August 20, 2007 letter, the applicant amended the AMP to Structures Monitoring Program for the LRA Table 3.5.2-29 AMR line item and revised Note 547 accordingly.

In LRA Table 3.5.2-29, the applicant proposed to manage cracking, loss of material, and change in material properties of reinforced concrete pipe exposed to soil environments with the Structures Monitoring Program. The applicant's AMR methodology determined that reinforced concrete pipe in soil environments has the same aging effects as structural concrete.

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. This program manages the aging effects of civil/structural commodities within the scope of license renewal by periodic inspection and monitoring of the condition of structures and structure component supports to detect and determine the extent of aging degradation leading to loss of intended functions. The program requires inspection of inaccessible surfaces of reinforced concrete pipe when exposed by removal of backfill for any reason. The program notifies the structural systems engineer when and where below-grade concrete pipe is exposed for an inspection before backfill is commenced. On the basis of its review and because these components will be periodically visually inspected, the staff finds the aging effects cracking, loss of material, and change in material properties of reinforced concrete pipe exposed to soil environments effectively managed by the Structures Monitoring Program.

In LRA Table 3.5.2-29, the applicant proposed to manage loss of material of stainless steel platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures (includes support members, welds, bolted connections, support anchorages to building structures) exposed to raw water environments with the Structures Monitoring Program.

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.24. This program manages the aging effects of civil/structural commodities within the scope of license renewal by periodic inspection and monitoring of the condition of structures and structure component supports to detect and determine the extent of aging degradation leading to loss of intended functions. The program periodically visually inspects stainless steel platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures (includes support members, welds, bolted connections, support anchorages to building structures) for loss of material in raw water. On the basis of its review and because these components will be inspected visually periodically, the staff finds the aging effect loss of material of stainless steel platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures (includes support members, welds, bolted connections, support anchorages to building structures) exposed to raw water effectively managed by the Structures Monitoring Program.

LRA Table 3.5.2-29 states that elastomer seals and gaskets exposed to soil environments have no AERMs. The applicant stated in discussions with the staff that there is no industry operating experience showing elastomer seals and gaskets exposed to soil environments with AERMs. The HNP AMR methodology concluded that the actual specific neoprene boot component for this line item has no aging effect in soil. The applicant stated that plant-specific operating experience with this component shows no aging effects. Plant-specific operating experience shows no aging effects for neoprene boots. On the basis of its review of industry research and plant-specific operating experience, the staff concludes that elastomer seals and gaskets exposed to soil environments have no AERMs.

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).

3.5.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the containments, structures, component 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).

3.6 Aging Management of Electrical and Instrumentation and Controls System

This section of the SER documents the staff's review of the applicant's AMR results for the electrical and instrumentation and controls (I&C) system components and component groups of:

- non-EQ insulated cables and connections
- metal enclosed bus and connections
- high-voltage insulators
- switchyard bus and connections
- transmission conductors and connections
- uninsulated ground 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 system components and component groups. LRA Table 3.6.1, "Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 for Electrical Components," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the electrical and I&C system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience 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 operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

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 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 3.6.2.1.

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 3.6.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.6.2.2.

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 and environment combinations specified. The staff's evaluations are documented in SER Section 3.6.2.3.

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 3.6-1 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 Program (B.3.2)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.6.2.2.1)
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	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.33)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.6.2.1)

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
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	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B.2.34)	Consistent with GALL Report, which recommends no further evaluation (See SER 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	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.35)	Consistent with GALL Report, which recommends no further evaluation (See SER 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	Boric Acid Corrosion Program (B.2.4)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.6.2.1)
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	Not applicable	Not Consistent with GALL Report (See SER Section 3.6.2.3)
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 Program (B.2.36)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.6.2.1)

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
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 Program (B.2.36)	Consistent with GALL Report, which recommends no further evaluation (See SER 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.2.31)	Consistent with GALL Report, which recommends no further evaluation (See SER 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 Program (B.2.36)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.6.2.1)
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	Consistent with GALL Report for which further evaluation is recommended (See SER Section 3.6.2.2)
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	Consistent with GALL Report for which further evaluation is recommended (See SER Section 3.6.2.2)

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
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	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.37)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.6.2.1)
Fuse Holders (Not Part of a Larger Assembly) - insulation material (3.6.1-14)	None	None	No	None	Consistent with GALL Report

The staff's review of the electrical and I&C system component groups followed any one of several approaches. One approach, documented in SER Section 3.6.2.1, 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 3.6.2.2, 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 3.6.2.3, 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 electrical and I&C system 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, AERMs, and the following programs that manage aging effects for the electrical and I&C system components:

- Boric Acid Corrosion Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits Program
- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Metal Enclosed Bus Program
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

LRA Table 3.6.2-1 summarizes AMRs for the electrical and I&C system components and indicates 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's evaluation follows.

3.6.2.1.1 Hardening and Loss of Strength Due to Elastomer Degradation

The discussion column of LRA Table 3.6.1, item 3.6.1-10, states that elastomer degradation of metal enclosed bus enclosure assemblies is managed by the Metal-Enclosed Bus Program. The staff noted that the AMR results line that refers to LRA Table 3.6.1, item 3.6.1-10, includes a Note E.

The staff reviewed the AMR results line for Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line item of the GALL Report; however, where the GALL Report recommends GALL AMP XI.S6, "Structures Monitoring Program," the applicant has proposed the Metal-Enclosed Bus Program.

As reported in SER Section 3.0.3.1.11, the staff found the Metal-Enclosed Bus Program acceptable for inspection of the metal enclosed bus elastomer degradation. On this basis, the staff finds the AMP credited for these AMR result items acceptable.

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).

3.6.2.2 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 system 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 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 3.6.2.2.The staff's review of the applicant's further evaluation follows.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

The staff reviewed LRA Section 3.6.2.2.1 against the criteria in SRP-LR Section 3.6.2.2.1.

LRA Section 3.6.2.2.1 states that EQ is a TLAA as defined in 10 CFR 54.3.

SRP-LR Section 3.6.2.2.1 states that the applicants are required to evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SRP-LR Section 4.4 addresses evaluation of TLAAs.

SER Section 4.4 documents the staff's review of the applicant's evaluation of this TLAA. Based on the review, staff concludes that the applicant has met the criteria of SRP-LR Section 3.6.2.2.1.

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.

LRA Section 3.6.2.2.2 addresses degradation of insulator quality due to salt deposits or surface contamination and loss of material due to mechanical wear, stating that according to the GALL Report degradation of insulator quality could occur in high-voltage insulators due to the presence of salt deposits and surface contamination but that such degradation is not an AERM for the following reasons. Various airborne materials (*e.g.*, dust, salt and industrial effluents) can contaminate insulator surfaces. Surface contamination can be a problem in areas of concentration of airborne particles due to proximity to facilities that discharge soot or ocean areas where salt spray is prevalent. A large buildup of contamination that facilitates conductor voltage tracking along the surface can lead to insulator flash-over. The buildup of surface contamination is typically slow and gradual and even slower in rural areas with generally fewer suspended particles and lighter SO_2 concentrations in the air than in urban areas. HNP is located in a rural area, approximately 140 miles inland from the Atlantic coast where airborne particle concentrations are comparatively low and utilizes a fresh-water reservoir for cooling. Consequently, the rate of contamination buildup on the high-voltage insulators is washed away naturally by rainwater and not significant. The glazed surface on the high-voltage insulators aids in the removal of this contamination.

As stated in the GALL Report, loss of material due to mechanical wear caused by wind could occur in high-voltage insulators but is not an AERM for the following reasons. Loss of material due to mechanical wear is an aging effect for strain and suspension insulators subject to significant movement. Movement of the insulators can be caused by wind causing the supported transmission conductor to swing from side to side. If frequent enough, this swinging could cause wear in the metal contact points of the insulator string and between an insulator and its supporting hardware. Although possible, experience shows that the transmission conductors normally do not swing and that any movement in strong winds dampens quickly when the wind subsides. Routine inspections of high-voltage insulators have detected no wear. Although rare, surface rust may form where the galvanizing burns off from flash-over from lightning strikes. Surface rust is not a significant concern and would not cause a loss of intended function if unmanaged. The conclusion is that loss of material due to wear is not an AERM for the high-voltage insulators within the scope of this review.

SRP-LR Section 3.6.2.2.2 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.

Staff Evaluation. Because HNP is not located near facilities that discharge soot or near the sea coast and because plant-specific operating experience shows no degradation of insulator quality, the staff found that such degradation due to salt deposits or surface contamination is not an AERM for high-voltage insulators.

The staff noted that, although loss of material of insulators due to mechanical wear is possible, experience shows that transmission conductors normally do not swing significantly. When they swing in a substantial wind, they do not continue to swing long after the wind subsides. The applicant's design and installation consider wind loading that can cause transmission lines and insulators to sway. The staff also noted that the applicant's routine maintenance inspections have found no loss of material of insulators due to mechanical wear; therefore, the staff determined that loss of material due to wear is not an aging effect to cause a loss of insulator intended function.

Based on the technical justification identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.6.2.2.2. For those line items that apply to LRA Section 3.6.2.2.2, the staff determines 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).

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

The staff reviewed LRA Section 3.6.2.2.3 against the criteria in SRP-LR Section 3.6.2.2.3.

LRA Section 3.6.2.2.3 addresses 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, stating that evaluated switchyard buses and connections have no AERMs. The switchyard buses within the scope of this review are constructed of rigid 5-inch, Schedule 80 aluminum pipe and are connected to short lengths of flexible conductors that do not normally vibrate supported by station post insulators mounted to static structural components *(e.g.*, cement footings and structural steel). For this design configuration wind-induced vibration is not an aging mechanism.

Where there are no connections to moving or vibrating equipment, loss of material due to vibration is not an AERM. Aluminum buses exposed to the service conditions of the 230kV switchyard experience no appreciable aging effects except minor oxidation, which does not impact switchyard bus ability to perform its intended function; therefore, the conclusion is that general corrosion from oxidation of the switchyard bus is not an AERM.

The bolted connections for the switchyard bus are to station post insulators that support it. All other bus connections are welded. Switchyard bus connection components are of cast aluminum, galvanized steel, and stainless steel, no organic materials. The station post insulators supporting the switchyard bus are clamped to it by an aluminum pad-type connector and fastened to the clamp connector by either galvanized or stainless steel bolts. Components in the 230kV switchyard are exposed to precipitation but connection materials exposed such service conditions experience no appreciable aging effects except minor oxidation, which does not impact switchyard bus ability to perform its intended function. The steel bolting hardware in this application has been selected for its ability to inhibit rust. Operating experience shows that corrosion of the structural bolting in this application is not so significant as to cause a loss of intended function.

The aging effects of loss of material and loss of conductor strength addressed in the GALL Report require no management. Loss of transmission conductor mounting hardware material due to wind-induced abrasion and fatigue is an applicable aging mechanism but not so significant as to cause a loss of intended function. Wind-induced abrasion and fatigue could be caused by transmission conductor vibration; however, a high wind loading factor of 90 miles per hour was a consideration in the design and installation of transmission conductors and high-voltage insulators in the transmission and distribution network. Strong winds could cause the transmission conductors to sway from side to side and, If frequent enough, could cause transmission conductor mounting hardware to wear. Although possible, experience shows that the transmission conductors normally do not swing and that any movement in strong winds dampens when the wind subsides; therefore, the conclusion is that loss of mounting hardware material caused by transmission conductor vibration (sway) and fatigue is not an AERM.

Loss of transmission conductor strength due to corrosion is an aging effect but ample design margin makes it not so significant as to cause a loss of intended function. Transmission conductors are of the aluminum conductor steel-reinforced (ACSR) type constructed of strand wound around a steel core with no organic materials. The most prevalent mechanisms for loss of ACSR transmission conductor strength are steel core corrosion and aluminum strand pitting. For ACSR transmission conductors, degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles, SO_2 concentration, precipitation, fog chemistry, and meteorological conditions. Corrosion of ACSR transmission conductors is very slow in rural areas with generally fewer suspended particles and lighter SO_2 concentrations in the air than in urban areas. HNP is located in a rural area with comparatively low airborne particle concentrations; consequently, air quality is not a significant contributor to this aging mechanism. There is a set composite conductor strength percentage at which transmission conductors are replaced. The National Electrical Safety Code (NESC) requires on installed conductors a maximum tension of 60 percent of the ultimate conductor strength. The NESC also sets the maximum tension a conductor must be designed to withstand under heavy load requirements for ice, wind, and temperature.

Ontario Hydroelectric tests showed a 30-percent loss of composite conductor strength of an 80-year old transmission conductor due to corrosion. Assuming a 30-percent loss of strength, there would still be significant margin between NESC requirements and actual conductor strength. These requirements were evaluated for applicability to the specific transmission conductors at HNP. HNP is in the medium loading zone; therefore, the Ontario Hydroelectric heavy loading zone study is conservative. The transmission conductors with the smallest ultimate strength margin *(i.e.*, 1272 MCM ACSR) were used as illustrations. The ultimate strength of 1272 MCM ACSR is 34,100 lb. and the maximum design tension 12,000 lb. The margin between the maximum design tension and the ultimate strength is 22,100 lb. (*i.e.*, a 64.9 percent (22,100/34,100) ultimate strength margin). The Ontario Hydroelectric study showed a 30-percent loss of composite conductor strength in an 80-year old conductor. For the 1272 MCM ACSR transmission conductors, a 30-percent loss of ultimate strength would mean a 34.9-percent ultimate strength margin between what the NESC requires and the actual strength in an 80-year old conductor. The transmission conductors within the scope of this review have relatively short spans, the longest approximately 485 ft.; therefore, the tension exerted on the conductors is less than what would be exerted in typical applications of up to 1000 ft. in length. This evaluation shows ample design margin in the transmission conductors. Based on the conservatism in ultimate strength margin, the conclusion is that loss of conductor strength is not an AERM for the ACSR transmission conductors within the scope of this review requiring aging management for the period of extended operation.

As to the GALL Report aging effect of increased resistance of electrical connections, conductor connections are generally compression-bolted with no organic materials. Connection materials exposed to the 230kV switchyard service conditions experience no appreciable aging effects except minor oxidation, which does not impact conductor connection ability to perform its intended function. To reduce chances of corrosion transmission conductor connection surfaces are coated with an anti-oxidant compound (a grease-type sealant) before the connection is tightened to prevent the formation of oxides on the metal surface or the entry of moisture into the connection. Operating experience shows this method of installation to provide a corrosion-resistant connection of low electrical resistance; therefore, the conclusion is that general corrosion from the oxidation of switchyard connection surface metals is not an AERM. The only bolted transmission conductor connections are those to the switchyard bus and to the high-voltage bushings on the main power transformers. Selection of the aluminum bolting hardware for the connection to the switchyard bus was for compatibility with the aluminum connector/conductor coefficient of thermal expansion to maintain the contact pressure of the bolt and washer combination in the connector to the initial vendor-specified torque value. HNP design incorporates the use of stainless steel Belleville washers on the bolted electrical connections to the main power transformers to compensate for temperature changes, maintain the proper torque, and prevent loosening of dissimilar metal connection hardware. This method of assembly is consistent with the good bolting practices recommended in EPRI Technical Report 1003471, "Bolted Joint Maintenance and Applications Guide," December 2002. Connection materials exposed to the 230kV switchyard service conditions may experience minor oxidation and an increased resistance across the electrical connection. For reasonable assurance that the electrical continuity function of the connection is maintained, the applicant will include the connections in the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The scope of this program will include the bolted connections on the overhead transmissions conductors from the high-voltage bushings on the main power transformers to the switchyard bus.

SRP-LR Section 3.6.2.2.3 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 may 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 these aging effects are adequately managed.

Staff Evaluation. The staff reviewed LRA Section 3.6.2.2.3 and the applicant's bases documents. Based on the review, the staff noted that the design and installation consider wind loading that can cause transmission lines and insulators to vibrate. Experience shows that transmission conductors normally do not swing significantly. When they do swing in a substantial wind, they do not continue to swing long time after the wind subsides. In addition, the applicant confirmed that no plant-specific operating experience or staff generic communication shows loss of material of transmission conductors due to vibration or sway; therefore, the staff found that loss of material caused by transmission conductor vibration or sway is not an AERM and will not cause a loss of conductor intended function.

The applicant stated that tests by Ontario Hydroelectric show a 30-percent loss of composite conductor strength of an 80-year old ACSR conductor due to corrosion. Assuming a 30-percent loss of strength, there would be significant margin between National Electrical Safety Code requirements and actual conductor strength. As HNP is in the medium loading zone and the transmission conductors within the scope of the license renewal have relatively short spans, the Ontario Hydroelectric heavy loading zone study is conservative. Corrosion of a steel core caused by loss of zinc coating or aluminum strand pitting corrosion is a very slow-acting aging effect even slower in areas with few suspended particles and sulphur dioxide concentrations in the air than in urban or industrial areas. HNP transmission conductors do not have air particulate or contaminants as in urban or heavy industrial areas. The applicant also stated that, to reduce chances of corrosion, transmission conductor connection surfaces are coated with an anti-oxidant compound (a grease-type sealant) before tightening to prevent the formation of oxides on the metal surface or the entry of moisture into the connection; therefore, corrosion is not an aging mechanism for conductor intended function. Furthermore, EPRI 1003057 addresses the aging of high-voltage transmission conductors and concludes that the aging mechanism of vibration has no significant effects of concern for the intended function.

On the basis of its review, the staff found that corrosion of ACSR conductors is a very slow acting mechanism and that Ontario Hydroelectric test data bounded by the types of conductors at HNP show that transmission conductors will have ample strength through the period of extended operation. Operating experience shows no failure of transmission conductors due to vibration; therefore, the staff concludes that there are no AERMs for transmission conductors.

The applicant stated that pre-load maintenance of bolted switchyard bus connections is the appropriate design and the use of lock and Belleville washers that absorb vibration and prevent loss of pre-load. The staff noted that torque relaxation for bolted connections is a concern for transmission conductor connections. An electrical connection must be designed to remain tight and maintain good conductivity through a wide temperature range. This design requirement is difficult to meet if the materials specified for bolt and conductor have different rates of thermal expansion. For example, copper or aluminum bus/conductor materials expand faster than most bolting materials. With thermal stress added to stresses inherent at assembly, joint members or fasteners can yield. If plastic deformation occurs during thermal loading *(i.e.*, heat up) the joint will be loose when the connection cools. EPRI TR-104213, "Bolted Joint Maintenance & Application Guide," recommends inspection of bolted joints for evidence of overheating, burning or discoloration, and loose bolts. Operating experience shows this method of installation for corrosion-resistant connections of low electrical resistance. The staff confirmed during the plant walkdown and discussions with the applicant's technical personnel that the only bolted transmission conductor connections are those to the switchyard bus and to the high-voltage bushings on the main power transformers. Selection of the aluminum bolting hardware for the connection to the switchyard bus was for compatibility with the aluminum connector/conductor coefficient of thermal expansion to maintain the contact pressure of the bolt and washer combination in the connector to the initial vendor-specified torque value. The applicant also stated that periodic evaluations of switchyard connections within the scope of license renewal are by thermography as preventive maintenance. In addition, the applicant has included the switchyard connections in the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program for inspections during the period of extended operation. The scope of this program will include the bolted connections on the overhead transmission conductors from the high-voltage bushings on the main power transformers to the switchyard bus. The staff concluded that the aging mechanism of torque relaxation for transmission conductor bolted connections has been adequately addressed because of design in accordance with EPRI-104213 recommendations, periodic thermography of conductor and bus bolted connections, inspections by the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, and no adverse operating experience conditions.

Based on the programs identified above, the staff concludes that the applicant's programs 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 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).

3.6.2.2.4 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.

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. 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.

3.6.2.3.1 Electrical and I&C Systems - Summary of Aging Management Evaluation - Electrical and Instrumentation and Controls Components/Commodities – LRA Table 3.6.2-1

The staff reviewed LRA Table 3.6.2-1, which summarizes the results of AMR evaluations for the electrical/I&C components/commodities component groups.

Staff Evaluation. For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether it demonstrated that the effects of aging will be adequately managed to maintain intended functions consistent with the CLB for the period of extended operation. The staff's evaluation is in the following sections.

Fuse Holders (Not parts of a Larger Assembly Metallic Clamp)

The LRA Table 3.6.1, item 3.6.1-6 discussion column states that fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation of fuse holders (not parts of a larger assembly) with metallic clamps is not present; therefore, no AMP is required. Also, in LRA Table 3.6.2-1, plant-specific Note 604 states that fuse holders within the scope of the AMR are only in radiation-monitoring I&C circuits not subject to any aging mechanism because of their installed location and design configuration and low-current circuits with no appreciable thermal cycling or ohmic heating.

During the audit and review, the staff asked the applicant for details about the review criteria for this determination and the results of the plant walkdowns.

In its response, the applicant stated that fuse holder screening was against the criteria of GALL AMP XI.E5. Most fuse holders are in active devices (*e.g.*, control panels, switchgear, motor control centers, and termination cabinets. To determine the number of fuse holders outside of these active components, a query showing all fuses within the scope of license renewal produced a list of approximately 2600 items. Then control wiring diagrams, plant engineering expertise, and the equipment database determined which of these fuses were located within an active device so they could be eliminated from the process. This determination reduced the original list to fewer than 40 fuses installed only in radiation-monitoring I&C circuits. A walkdown of the remaining fuses found them in an air-conditioned environment with no external signs of aging degradation. During the audit and review, the staff reviewed the HNP program design calculation, plant-specific Note 604, the results of the screening process, walkdown reports, and plant drawings showing the location of the fuses.

Based on the review, the staff determined that fuse holders (not parts of a larger assembly metallic clamp) have no AERMs for the following reasons:

- I&C circuits characteristically operate at such low currents that no appreciable thermal cycling or ohmic heating occurs. As thermal cycling and ohmic heating affect power supply applications, they are not aging mechanisms for the I&C fuse holders within the scope of this review.

- The fuses within the scope of this evaluation are not removed routinely for maintenance, surveillance testing, or both; therefore, frequent manipulation is not an aging mechanism.

- Vibration is induced in fuse holders by the operation of external equipment (*e.g.*, compressors, fans, and pumps). The applicant's plant walkdown has verified that there are no direct causes of vibration for the fuse holder panels mounted separately to their own unistrut support structures on a concrete wall or column; therefore, vibration is not an aging mechanism.

- The applicant's plant walkdown has verified that there are no potential sources of chemical contamination in the area, and the fuse holders are enclosed entirely in a protective junction box even if chemical contamination were possible; therefore, with their installed location and design configuration, chemical contamination is not an aging mechanism.

- The applicant's plant walkdown has also verified that fuse holders within the scope of this evaluation are enclosed entirely in protective junction boxes located within the applicant's plant walkdown area, two protective barriers to moisture intrusion due to inclement weather. The areas within the applicant's plant walkdown housing the fuse holder junction boxes have safety-related room cooling. This installed configuration precludes the aging mechanism, as the moisture required for corrosion and oxidation is not present in this noncondensing atmosphere.

- The applicant has also verified that there are no sources of potential mechanical system leakage near the fuse holder junction boxes within the scope of this evaluation.

The staff finds that for this component type the aging effect is not present; therefore, no AMP is required for fuse holders.

Uninsulated Ground Conductors and Connections.

LRA Section 3.6.2.1.6 and Table 3.6.2-1 state that uninsulated ground conductors and connections are exposed to air-outdoor and soil and the AMR indicates that they have no AERMs. In addition, the applicant states that the uninsulated ground conductors and connections commodity group for lightning protection has air terminals *(i.e.*, lightning rods), ground rods, ground cables, and connections. Above-grade uninsulated ground conductors are exposed to the outside (yard) environment. Copper materials exposed to this service environment experience no appreciable aging effects except minor oxidation, which does not impact the ability of uninsulated ground conductors to perform their intended function. For below-grade uninsulated ground conductors, sulfates and other chemicals in the groundwater and soil may accelerate the aging process; however, the results of chemical analysis have determined that the site groundwater/soil is not aggressive. Additionally, the below-grade ground cables and connections in contact with groundwater and soil are coated with at least a 1/16-inch layer of lead. The lead coating on the ground cables precludes potential aging effects; therefore, no aging management activities are required for the period of extended operation.

The staff's review of available industry technical information on material aging revealed no AERMs for copper grounding materials. Industry and plant-specific operating experience show no failures of copper ground systems due to aging effects. The applicant has confirmed in its program basis calculation that routine inspections of the grounding system have found no degradation due to aging effects.

The staff found that torque relaxation for bolted connections is a concern for ground connections. An electrical connection design must remain tight and maintain good conductivity through a wide temperature range. During the audit and review, the staff asked the applicant why torque relaxation for bolted connections was not a concern.

In response the applicant stated that torque relaxation of bolted connections on uninsulated ground conductors is not a concern because all connections are bonded together by the powder weld (*i.e.*, CADWELD®) process. Operating experience shows that this method of bonding produces a permanent exothermic connection that will not loosen; therefore, torque relaxation of bolted connections on uninsulated ground conductors is not an AERM for the period of extended operation. The staff determined that, because there are no bolted connections on uninsulated ground conductors within the scope of license renewal, torque relaxation of is not a concern.

The staff finds that for this component type the aging effect is not present; therefore, no AMP is required for uninsulated ground conductors and connections.

<u>High-Voltage Power Cables</u>.

LRA Table 3.6.2-1 states that high-voltage power cables have no AERMs and indicates (by Note J) for material, environment, aging effect, and AMP that neither the component nor the material and environment combination is evaluated in GALL Report.

The plant-specific Note "602" for these cables states that HNP paper-insulated lead-covered cables use a lead sheath to prevent moisture penetration from degrading the cable insulation. The cables have a 0.150-inch thick layer of lead over the cable insulation with an overall jacket of Okolene (polyethylene) for a virtually impenetrable barrier against moisture. Beneath the lead wall is the cable insulating medium of oil-impregnated paper and metallized paper tape. The impregnation of the paper tape improves the insulation electrical resistance and provides an extra layer of defense against moisture ingress. The highly refined oil for the insulating medium also dissipates heat from the conductors and cools the cable when operating under load. Plant-specific operating experience shows this design as extremely reliable in its underground application. The HNP paper-insulated lead-covered cables are similar in design to the Turkey Point medium-voltage cables evaluated and deemed acceptable in Section 3.7.2.2.3 of NUREG-1759, "Safety Evaluation Report Related to the License Renewal of Turkey Point Nuclear Plant, Units 3 & 4." Therefore, based on their design and operating experience, the paper-insulated lead-covered cables are aptly suited for their service conditions and acceptable for the period of extended operation.

The staff noted that Turkey-Point medium-voltage ethylene propylene rubber cables are rated at 15 KV; however, HNP oil-filled high-voltage cables operate at 230kV. The staff determined that HNP cable operating characteristic and life depend on dielectric properties and that the applicant needs to address how it plans to manage the aging effects; therefore, the staff asked the applicant for (1) the AMP for periodic testing of insulating oil in the cable system to prevent degradation of its dielectric properties, (2) the AMP for vendor-recommended maintenance of the oil-filled cable system during the period of extended operation, (3) details of periodic visual inspections and walkdowns to date and for the period of extended operation to monitor for oil leakage and check pothead bolt torque, and (4) an explanation of the instrumentation including any alarms to monitor oil levels for the cable system.

To address the staff's concern, the applicant stated that it will revise its aging management evaluations in an amendment to the LRA. In its response the applicant stated:

The HNP cables are high-voltage, oil-filled, paper insulated, lead-sheathed cables. The lead sheath is designed to prevent moisture from penetrating the cable and degrading the cables insulation. The HNP cables have an Okolene (Polyethylene, PE) jacket. The lead sheath combined with the overall PE jacket has proven to be an effective barrier against moisture.

The mechanical components that support the oil-filled cable system are evaluated in Sections 2.3.3.81, and Table 3.3.2-69 (page 3.3-426) of the LRA. Currently, the System Engineer performs periodic visual inspections and walkdowns of the oil-filled cable system. For the period of extended operation, external visual inspections of the cable systems oil filled tanks will become part of the External Surfaces Monitoring Program as shown in Table 3.3.2-69 (page 3.3-426) of the LRA. The External Surfaces Monitoring Program is described in Section B.2.22 of the LRA.

To preserve the electrical continuity function of the oil-filled cable system during the period of extended operation, a power factor (Doble) test will be performed on the oil-filled cable. This test will measure dielectric losses of the cables insulation to provide an indication of a breakdown of the cable insulation properties. The oil-filled cables are to be tested at least every 4 years. This is an adequate period to preclude failures of the conductor insulation since experience has shown that aging degradation is a slow process. A 4-year testing interval will provide multiple data points during a 20-year period, which can be used to characterize the degradation rate. The first tests for license renewal are to be completed prior to the period of extended operation. The elements of this test program will be provided in an AMP. The insulating oil environment of the cable system is documented in Table 3.0-1 (page 3.0-7) of the LRA. Periodic testing of the insulating oil in the cable system is not a vendor recommended activity. This is a closed system, with no moving parts, that should remain closed so as not to introduce contaminants. This activity would be performed as a corrective action based on the results of power factor testing. Corrective actions such as testing the insulating oil will be implemented through the HNP Corrective Action Program. The Corrective Action Program is implemented by the HNP QA Program in accordance with 10 CFR 50, Appendix B.

System leakage discovered during the conduct of the External Surfaces Monitoring Program would warrant the need for corrective actions during the period of extended operation. Corrective actions such as checking the torque of the pothead bolts will be implemented through the HNP Corrective Action Program. The cable system's oil filled tanks are equipped with high-low pressure switches that are periodically calibrated by the Transmission Depart under Interface Agreement with the site. The pressure switches provide annunciation in the Energy Control Center.

Based on review of vendor manual and discussions with the cable manufacturer, the staff determined that a positive oil pressure must be maintained in the cable system to prevent any moisture intrusion and to maintain the dielectric property of the oil in the cable system to manufacturer specifications. The oil-filled cable system must be inspected for oil leaks and the dielectric property of the cables should be verified in accordance with industry standards.

The staff interviewed the applicant's technical personnel, reviewed the program basis calculation and the corrective action database, and confirmed that there are no plant-specific cable degradation issues. The staff reviewed the applicant's response and determined that the proposed AMP with the External Surfaces Monitoring Program, periodic visual inspections and periodic walkdown of the oil-filled system by system engineer, and instrumentations to monitor for oil pressure in the cable system are adequate to manage potential breakdown of insulation leading to electrical failure during the period of extended operation.

In its letter dated August 20, 2007, the applicant added LRA Sections Appendix A.1.1.40 and Appendix B.2.38 describing its Oil-Filled Cable Testing Program. It also amended LRA Section 3.6.2.1, "Materials, Environment, Aging Effects Requiring Management and Aging Management Programs," and LRA Tables 3.6.1 and 3.6.2-1. The staff's evaluation of the applicant's Oil-Filled Cable Testing Program is documented in SER Section 3.0.3.3.1.

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).

3.6.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the electrical and I&C 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).

3.7 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, pending resolution of CI 3.4-1, 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 FSAR 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 activities authorized by the renewed license 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.

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11. ABSTRACT *(200 words or less)*

This safety evaluation report (SER) documents the technical review of the Shearon Harris Nuclear Power Plant (HNP), Unit 1, license renewal application (LRA) by the United States (US) Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated November 14, 2006, Carolina Power & Light (CP&L) Company, doing business as Progress Energy Carolinas, Inc., submitted the LRA in accordance with Title10, Part 54, of the Code of Federal Regulations, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." CP&L requests renewal of the Unit 1 operating license (Facility Operating License Number NPF-63) for a period of 20 years beyond the current expiration at midnight October 24, 2026, for Unit 1. HNP is located approximately 16 miles southwest of Raleigh, NC. The NRC issued the construction permit for Unit 1 on January 27, 1978, and operating license on January 12, 1987. Unit 1 is of a dry ambient pressurized water reactor design. Westinghouse supplied the nuclear steam supply system and Daniel International originally designed and constructed the balance of the plant with the assistance of its agent, Ebasco. The Unit 1 licensed power output is 2900 megawatt thermal with a gross electrical output of approximately 900 megawatt electric.
This SER presents the status of the staff's review of information submitted through July 21, 2008, the cutoff date for consideration in the SER. The staff identified an open item and two confirmatory items that were resolved before the staff made a final determination on the application. SER Sections1.5 and1.6 summarizes these items and their resolution. Section 6.0 provides the staff's final conclusion on the review of the HNP LRA.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

10 CFR 54, license renewal, Shearon Harris, scoping and screening, aging management, time-limited aging analysis, TLAA, safety evaluation report

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