SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This section of the safety evaluation report (SER) contains the staff's evaluation of the applicant's aging management programs (AMPs) and aging management reviews (AMRs). In its LRA Appendix B, the applicant described the 34 AMPs that it relies on to manage or monitor the aging of long-lived, passive components and structures.

In LRA Section 3, the applicant provided the results of the AMRs for those structures and components that were identified in License Renewal Application (LRA) Section 2 as being 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 the LRA, the applicant credited NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated July 2001. The GALL Report contains the staff's generic evaluation of the existing plant programs and documents the technical basis for determining where existing programs are adequate without modification, and where existing programs should be augmented for the extended period of operation. The evaluation results documented in the GALL Report indicate that many of the existing programs are adequate to manage the aging effects for particular structures or components for license renewal without change. 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 the programs at its facility correspond to those reviewed and approved in the GALL Report.

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

The GALL Report identifies (1) systems, structures and components (SSCs), (2) structure and component (SC) materials, (3) the environments to which the SCs are exposed, (4) the aging effects associated with the materials and environments, (5) the AMPs that are 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 using the GALL Report would improve the efficiency of the license renewal review, the staff conducted a demonstration project to exercise the GALL Report process and to determine the format and content of a safety evaluation based on this process. The results of the demonstration project confirmed that the GALL process will improve the efficiency and effectiveness of the LRA review, while maintaining the staff's focus on public

health and safety. NUREG-1800, "Standard Review Plan for the Review of License Renewal Applications," dated April 2001 (SRP-LR), was prepared based on both the GALL Report model and lessons learned from the demonstration project.

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

In addition to its review of the LRA, the staff conducted an onsite audit of selected aging management reviews and associated AMPs, as described in the "Audit Plan For License Renewal Application Aging Management Programs Aging Management Review Results, Brunswick Steam Electric Plant, Units 1 and 2," dated December 23, 2004 (ADAMS ML050110445). The onsite audits and reviews are designed to maximize the efficiency of the staff's review of the LRA. The need for formal correspondence between the staff and the applicant is reduced, and the result is an improvement in the review's efficiency. In addition, the applicant could respond to questions, and the staff could readily evaluate the applicant's responses.

3.0.1 Format of the License Renewal Application

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

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

- Table 1: 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 is the first table type in LRA Section 3.
- Table 2: 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 is the second table type in LRA Section 3; and "y" indicates the system table number.

The content of the previous applications and the Brunswick Steam Electric Plant (BSEP) application is essentially the same. The intent of the revised format used for the BSEP application was to modify the tables in Chapter 3 to provide additional information that would assist the staff in its review. In Table 1, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In Table 2, the applicant identified the linkage between the scoping and screening results in Chapter 2 and the AMRs in Chapter 3.

3.0.1.1 Overview of Table 1

Table 3.x.1 (Table 1) provides a summary comparison of how the facility aligns with the corresponding tables of the GALL Report, Volume 1. The table is essentially the same as Tables 1 through 6 provided in the GALL Report, Volume 1, 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 provides the reviewer with a means to cross-reference from Table 2 to Table 1. The "Discussion" column is used by the applicant to provide clarifying and amplifying information. The following are examples of information that might be contained in this column:

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

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

3.0.1.2 Overview of Table 2

Table 3.x.2-y (Table 2) provides the detailed results of the AMRs for those components identified in LRA Section 2 as being subject to an AMR. The LRA contains a Table 2 for each of the components or systems within a system grouping (e.g., reactor coolant systems, engineered safety features, auxiliary systems, etc.). For example, the engineered safety feature's (ESF's) group contains tables specific to the containment spray system, containment isolation system, and emergency core cooling system. Table 2 consists of the following nine columns:

(1) Component/Commodity – The first column identifies the component types from LRA Section 2 that are subject to aging management review. The component types are listed in alphabetical order.

(2) Intended Function – The second column contains the license renewal intended functions (including abbreviations where applicable) for the listed component types. Definitions and abbreviations of intended functions are contained within the Intended Functions table of LRA Section 2.

(3) Material – The third column lists the particular materials of construction for the component type.

(4) Environment – The fourth column lists the environment to which the component types are exposed. Internal and external service environments are indicated and a list of

these environments are provided in the Internal Service Environments and External Service Environments tables of LRA Section 3.

(5) Aging Effect Requiring Management – The fifth column lists aging effects requiring management (AERMs). As part of the aging management review process, the applicant determined any AERM for each combination of material and environment.

(6) Aging Management Programs – The sixth column lists the AMPs that the applicant used to manage the identified aging effects.

(7) GALL Volume 2 Item – The seventh column lists the GALL Report item(s) that the applicant identified as being similar to the AMR results in LRA. The applicant compared each combination of component type, material, environment, AERM, and AMP in SER Table 2 to the items in the GALL Report. If there were no corresponding items in the GALL Report, the applicant left the column blank. In this way, the applicant identified the AMR results in the LRA tables that corresponded to the items in the GALL Report tables.

(8) Table 1 Item – The eighth column lists the corresponding summary item number from Table 1. If the applicant identifies AMR results in Table 2 that are consistent with the GALL Report, then the associated Table 3.x.1 line summary item number should be listed in Table 2. If there is no corresponding item in the GALL Report, then column eight is left blank. That way, the information from the two tables can be correlated.

(9) Notes – The ninth column lists the corresponding notes that the applicant used to identify how the information in Table 2 aligns with the information in the GALL Report. The notes identified by letters were developed by a Nuclear Energy Institute working group and will be used in future license renewal applications. Any plant-specific notes are identified by a number and provide additional information concerning the consistency of the line item with the GALL Report.

3.0.2 Staff's Review Process

The staff conducted the following three types of evaluations of the AMRs and associated 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 with the GALL Report.

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

(3) For other items, the staff conducted a technical review per 10 CFR 54.21(a)(3).

The staff performed an onsite audit and technical review of the license renewal applicant's AMPs and AMRs during the weeks of January 10, 2005, and February 7, 2005. These audit and technical reviews are to determine whether the effects of aging on structures and components can be adequately managed so that their intended functions can be maintained

consistently with the plant's current licensing basis (CLB) for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Detailed results of the staff's onsite audit are documented in "Audit and Review Report - Plant Aging Management Reviews and Programs - Brunswick Steam Electric Plant, Units 1 and 2" (Audit and Review Report), dated June 21, 2005.

3.0.2.1 Review of AMPs

For those AMPs for which the applicant claimed consistency with the GALL AMPs, the staff conducted either an audit or a technical review to verify that the applicant's AMPs were consistent with the AMPs in the GALL Report. For each AMP that had one or more deviations, the staff evaluated each deviation to determine whether the deviation was acceptable and whether the AMP, as modified, would adequately manage the aging effect(s) for which it was credited.

For AMPs that were not evaluated in the GALL Report, the staff performed a full review to determine the adequacy of the AMPs. The staff evaluated the AMPs against the following ten (10) program elements defined in SRP-LR Appendix A.

(1) Scope of the Program – Scope of the program should include the specific structures and components 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 functions(s).

(4) Detection of Aging Effects – Detection of aging effects should occur before there is a loss of structure or component intended functions(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 a 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 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 managed adequately so that the structure and component 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) and (10) are documented in the Audit and Review Report and are summarized in SER Section 3.0.3.

The staff reviewed the applicant's Corrective Action Program and documented its evaluations in SER Section 3.0.4. The staff's evaluation of the Corrective Action Program included assessment of the following program elements: (7) corrective actions, (8) confirmation process, and (9) administrative controls.

The staff reviewed the updated final safety analysis report (UFSAR) supplement for each AMP to determine if it provided an adequate description of the program or activity, as required by 10 CFR 54.21(d).

3.0.2.2 Review of AMR Results

LRA Table 2 contains information concerning whether or not the AMRs align with the AMRs identified in the GALL Report. For a given AMR in Table 2, the staff reviewed the intended function, material, environment, AERM, and AMP for a particular component type within a system. The Table 2 AMRs that correlate with an AMR in the GALL report are identified by a reference item number in column seven called, "GALL, Volume 2 Item." The staff also conducted onsite audits to verify the correlation.

A blank column seven indicates that the applicant was unable to locate an appropriate corresponding combination in the GALL Report. The staff conducted a technical review of these combinations that were not consistent with the GALL Report.

The next column, column eight, "Table 1 Item," provides a reference number that indicates the corresponding row in Table 1. As discussed above, Table 1 provides a summary comparison of how the facility aligns with the corresponding tables of the GALL Report, Volume 1.

3.0.2.3 UFSAR Supplement

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

3.0.2.4 Documentation and Documents Reviewed

In performing its review, the staff relied heavily on the LRA, RAI responses, the SRP-LR, and the GALL Report. Also, during the onsite audit, the staff examined the applicant's justification, as documented in the staff's Audit and Review Report, to verify that the applicant's activities and programs will adequately manage the effects of aging on SSCs. 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

Table 3.0.3-1 presents the AMPs credited by the applicant and described in LRA Appendix B. The table also indicates the GALL Report AMP that the applicant claimed its AMP was consistent with (if applicable) and the SSCs for managing or monitoring aging. The section of the SER, in which the staff's evaluation of the program is documented, is also provided.

Table 3.0.3-1 BSEP's Aging Management Programs

BSEP's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Existing AMPs				
ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program (B.2.1)	Consistent	XI.M1	Reactor Vessel, Internals, and Reactor Coolant System; Containments, Structures, and Component Supports	3.0.3.1.1
Water Chemistry Program (B.2.2)	Consistent with exceptions	XI.M2	Reactor Vessel, Internals, and Reactor Coolant System; Engineered Safety Features Systems; Auxiliary Systems; Steam and Power Conversion Systems; Containments, Structures, and Component Supports	3.0.3.2.1
Reactor Head Closure Studs Program (B.2.3)	Consistent	XI.M3	Reactor Vessel, Internals, and Reactor Coolant System; Containments, Structures, and Component Supports	3.0.3.1.2
BWR Stress Corrosion Cracking Program (B.2.4)	Consistent	XI.M7	Reactor Vessel, Internals, and Reactor Coolant Systems; Engineered Safety Features; Auxiliary Systems; Steam and Power Conversion System	3.0.3.1.3
Flow-Accelerated Corrosion Program (B.2.5)	Consistent with exception and enhancement	XI.M17	Steam and Power Conversion Systems	3.0.3.2.2
Bolting Integrity Program (B.2.6)	Consistent with exceptions and enhancement	XI.M18	Service Water System	3.0.3.2.3
Open-Cycle Cooling Water System Program (B.2.7)	Consistent with enhancements	XI.M20	Auxiliary Systems; Steam and Power Conversion Systems	3.0.3.2.4

BSEP's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Closed-Cycle Cooling Water System Program (B.2.8)	Consistent with enhancements	XI.M21	Reactor Vessel, Internals, and Reactor Coolant System; Engineered Safety Features Systems; Auxiliary Systems; Steam and Power Conversion Systems; Containments, Structures, and Component Supports	3.0.3.2.5
Inspection of Overhead Heavy Load and Light Load Handling Systems Program (B.2.9)	Consistent with enhancements	XI.M23	Auxiliary Systems	3.0.3.2.6
Fire Protection Program (B.2.10)	Consistent with exceptions	XI.M26	Auxiliary Systems; Containments, Structures, and Component Supports	3.0.3.2.7
Fire Water System Program (B.2.11)	Consistent with enhancements	XI.M27	Auxiliary Systems; Containments, Structures, and Component Supports	3.0.3.2.8
Fuel Oil Chemistry Program (B.2.13)	Consistent with exceptions and enhancements	XI.M30	Auxiliary Systems	3.0.3.2.9
Reactor Vessel Surveillance Program (B.2.14)	Consistent with enhancement	XI.M31	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.2.10
ASME Section XI, Subsection IWE Program (B.2.18)	Consistent	XI.S1	Reactor Vessel, Internals, and Reactor Coolant System; Containments, Structures, and Component Supports	3.0.3.1.5
ASME Section XI, Subsection IWL Program (B.2.19)	Consistent with exception	XI.S2	Reactor Vessel, Internals, and Reactor Coolant System; Containments, Structures, and Component Supports	3.0.3.2.14
ASME Section XI, Subsection IWF Program (B.2.20)	Consistent with enhancement	XI.S3	Reactor Vessel, Internals, and Reactor Coolant System; Containments, Structures, and Component Supports	3.0.3.2.15
10 CFR Part 50, Appendix J Program (B.2.21)	Consistent	XI.S4	Reactor Vessel, Internals, and Reactor Coolant System; Containments, Structures, and Component Supports	3.0.3.1.6
Masonry Wall Program (B.2.22)	Consistent with enhancement	XI.S5	Containments, Structures, and Component Supports	3.0.3.2.16

BSEP's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Structures Monitoring Program (B.2.23)	Consistent with enhancements	XI.S6	Containments, Structures, and Component Supports	3.0.3.2.17
Protective Coating Monitoring and Maintenance Program (B.2.24)	Consistent with exception and enhancements	XI.S8	Containments, Structures, Component Supports	3.0.3.2.18
Reactor Coolant Pressure Boundary Fatigue Monitoring Program (B.3.1)	Consistent with exception and enhancements	XI.M1	Reactor Vessel, Internals, and Reactor Coolant System; Containments, Structures, and Component Supports	3.0.3.2.20
Environmental Qualification (EQ) Program (B.3.2)	Consistent	X.E1	Electrical Components	3.0.3.1.9
Reactor Vessel and Internals Structural Integrity Program (B.2.28)	Plant Specific		Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.3.1
Systems Monitoring Program (B.2.29)	Plant Specific		Heat Exchangers, Mechanical Components	3.0.3.3.2
Preventive Maintenance Program (B.2.30)	Plant Specific		RHR System, HPCI System, Standby Gas Treatment System, DG Fuel Oil System	3.0.3.3.3
Fuel Pool Girder Tendon Inspection Program (B.2.32)	Plant Specific		Containments, Structures	3.0.3.3.5
New AMPs				
Aboveground Carbon Steel Tanks Program (B.2.12)	Consistent	XI.M29	Auxiliary Systems	3.0.3.1.4
One-Time Inspection Program (B.2.15)	Consistent with exceptions and enhancement	XI.M32	Reactor Vessel, Internals, and Reactor Coolant Systems; Engineered Safety Features; Auxiliary Systems; Steam and Power Conversion Systems; Containment, Structures, and Component Supports	3.0.3.2.11
Selective Leaching of Materials Program (B.2.16)	Consistent with exceptions	XI.M33	Reactor Vessel, Internals, and Reactor Coolant Systems; Engineered Safety Feature Systems; Auxiliary Systems	3.0.3.2.12

BSEP's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Buried Piping and Tanks Inspection Program (B.2.17)	Consistent with exceptions	XI.M34	Engineered Safety Feature Systems; Auxiliary Systems	3.0.3.2.13
Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.25)	Consistent	XI.E1	Electrical Components	3.0.3.1.7
Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B.2.26)	Consistent with exceptions	XI.E2	Electrical and Instrumentation and Controls	3.0.3.2.19
Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.27)	Consistent	XI.E3	Electrical and Instrumentation and Controls	3.0.3.1.8
Phase Bus Aging Management Program (B.2.31)	Plant Specific		Electrical and Instrumentation and Controls	3.0.3.3.4

3.0.3.1 AMPS That Are Consistent with the GALL Report

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

- ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program (B.2.1)
- Reactor Head Closure Studs Program (B.2.3)
- BWR Stress Corrosion Cracking Program (B.2.4)
- Aboveground Carbon Steel Tanks Program (B.2.12)
- ASME Section XI, Subsection IWE Program (B.2.18)
- 10 CFR Part 50, Appendix J Program (B.2.21)

- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.25)
- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.27)
- Environmental Qualification (EQ) Program (B.3.2)

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

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.1, "ASME Section XI, Inservice Inspection (ISI), Subsections IWB, IWC and IWD Program." In the LRA, the applicant stated that this is an existing program that is consistent with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

This program consists of periodic volumetric, surface, and/or visual examination, and leakage test of Class 1, 2, and 3 pressure-retaining components and their integral attachments to detect degradation and determine appropriate corrective actions. The program was developed and prepared to meet the ASME Code, Section XI, 1989 Edition (no Addenda) and is subject to the limitations and modifications of 10 CFR 50.55a, with the exception of design and access provisions and pre-service examination requirements. BSEP is currently operating in accordance with the "Third Inspection Interval ISI Program Plan for Class 1, 2, and 3 Components and Their Supports."

Certain inspection requirements have been modified by the BSEP Risk Informed Inservice Inspection (RI-ISI) Program presented in Electric Power Research Institute (EPRI) Topical Report, TR-112657. The RI-ISI Program is described in a BSEP submittal, dated April 20, 2001, and in the corresponding NRC staff SER, dated November 28, 2001.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's Audit and Review Report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M1.

During the audit, the staff noted that, in the program description section of ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program, the applicant stated that the RI-ISI Program was discussed in EPRI Topical Report TR-112657. The staff informed the applicant that the NRC does not recognize or consider a currently approved RI-ISI Program (or any other currently approved relief requests) in evaluating an applicant's claim of consistency with the GALL Report because the RI-ISI Program and relief request are not part of the technical basis for the ASME ISI Program in the GALL Report. In addition, the currently approved RI-ISI Program and relief requests are only effective in the 10-year ISI Interval which means that they will not be applicable during the period of extended operation.

As documented in the staff's Audit and Review Report, the applicant stated that it will comply with 10 CFR 50.55a for the extended period of operation. The applicant also stated that the ASME Section XI ISI program description, which will be integrated into the USFAR supplement, will be revised to omit reference to the RI-ISI as a part of the program, along with information concerning a specific inspection interval. The revised UFSAR wording will read as follows:

> The ASME Section XI, Inservice Inspection, Subsection IWB, IWC, and IWD program consists of periodic volumetric, surface, and/or visual examination of components in accordance with applicable requirements and provisions of 10 CFR 50.55a.

The staff reviewed and determined that the applicant's response is acceptable on the basis that currently approved relief requests and approved Code cases will not be carried over into the period of extended operation.

In reviewing the scope of this program, the staff noted that, in LRA Tables 3.2.2-3, 3.2.2-5, and 3.2.2-7, the applicant credits the ASME Section XI, Inservice Inspection, Subsection IWB, IWC, and IWD Program, along with the Water Chemistry Program, for aging management of small-bore piping. However, small-bore piping is exempt from inspection under the ASME ISI program; therefore, this AMP would not be appropriate for inspecting these components. The staff asked the applicant to provide details of the program used to inspect small-bore piping (including pipe, fittings, and branch connections) for loss of material and cracking.

As documented in the staff's Audit and Review Report, the applicant stated that it will use the Water Chemistry Program and the ASME Section XI, Inservice Inspection, Subsection IWB, IWC, and IWD Program (for leakage inspections) for aging management of small-bore piping. In addition, the One-Time Inspection Program will be utilized for verification of program effectiveness. The staff determined that the applicant's response is acceptable on the basis that the approach is consistent with the GALL Report.

Operating Experience. In LRA Section B.2.1, the applicant stated that this program is implemented and maintained in accordance with the general requirements for engineering programs. This provides assurance that the program is effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews; qualified personnel are assigned as program managers, and are given authority and responsibility to implement the program; and adequate resources are committed to program activities.

The applicant stated that a search of condition reports and ISI history, including self-assessments and inspections, was conducted and showed the ASME Section XI ISI program to be critically monitored and effective. Based on these results, the plant's Operating Experience Program provides evidence that the program and maintenance practices are ensuring the continuing integrity of the ISI Class 1, 2, and 3 components.

The staff reviewed results of the operating experience review and selected BSEP self-assessment and inspection reports, as documented in the staff's Audit and Review Report, to ascertain the effectiveness of the ISI program. The applicant's self-assessment team identified no issues related to ISI program management or program implementation.

In addition to the self assessment, the staff reviewed a report documenting an inspection performed by staff at BSEP on March 20, 2004. As part of that effort, the staff inspectors reviewed ISI procedures, observed in-process ISI work activities, and reviewed selected ISI records. The inspectors observed portions of ultrasonic tests (UTs) on four welds to verify they were being performed acceptably. No findings of significance related to the ISI program were identified. The staff concluded that the documents reviewed support the applicant's assessment of program effectiveness.

On the basis of its review of the above industry and plant-specific operating experience and on discussions with the applicant's technical staff, the staff team concluded that ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

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

Conclusion. On the basis of its review and audit of the applicant's ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.3, "Reactor Head Closure Studs Program." In the LRA, the applicant stated that this is an existing program that is consistent with GALL AMP XI.M3, "Reactor Head Closure Studs."

In the LRA, the applicant stated that this program is credited for aging management of reactor head closure studs and stud components. The closure studs, nuts, bushings, and washers are included within the scope of the ASME Section XI inservice Inspection, Subsections IWB, IWC, and IWD Program. While BSEP is not committed to regulatory guide (RG) 1.65, the reactor head closure studs program preventive measures are consistent with the recommendations of the regulatory guide. Aging effects/mechanisms of concern are cracking due to stress corrosion cracking (SCC), and loss of material due to:(1) general corrosion, (2) crevice corrosion, and (3) pitting corrosion.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's Audit and Review Report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M3.

From a review of the applicant's documentation, the staff determined that, while BSEP is not committed to regulatory guide (RG) 1.65, the reactor head closure studs program preventive measures are consistent with the recommendations of the regulatory guide. Also, preventive measures consistent with the recommendations of the RG, such as inspections (UT, magnetic particle test (MT)/penetrant test (PT), etc.), and periodic lubrication with a corrosion inhibitor, are performed.

The ASME Section XI, Subsections IWB, IWC and IWD, Inservice Inspection Program uses a combination of visual, surface, and volumetric examinations of the studs, nuts, bushings, washers, and stud holes (including the flange threads) to detect discontinuities and flaws. Visual VT-2 examination of the entire reactor coolant pressure boundary to detect evidence of leakage from pressure-retaining components is routinely performed during pressure tests as required by the ASME Section XI, Subsections IWB, IWC and IWD, Inservice Inspection Program.

Operating Experience. In the LRA, the applicant stated that this program is implemented through the ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program which monitors the condition of the closure studs and stud components. The Reactor Head Closure Studs Program is implemented and maintained in accordance with the general requirements for engineering programs. This provides assurance that the program is effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews; qualified personnel are assigned as program managers, and are given authority and responsibility to implement the program; and adequate resources are committed to program activities.

The applicant further stated that a search of condition reports and ISI history was conducted, and no reports documenting deficiencies or problems with vessel head closure studs or stud components, or the Reactor Head Closure Studs Program, were found. Based on these results, the operating experience provides evidence that the program and maintenance practices are ensuring the continuing integrity of the reactor head closure studs and stud components.

Additionally, the applicant stated that, per ASME Section XI ISI requirements, the reactor pressure vessel studs are inspected every 10 years and the next series of inspections will be performed in 2007 and 2008.

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

Conclusion. On the basis of its review and audit of the applicant's Reactor Head Closure Studs Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that

the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3 BWR Stress Corrosion Cracking Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.4, "BWR Stress Corrosion Cracking Program." In the LRA, the applicant stated that this is an existing program that is consistent with GALL AMP XI.M7, "BWR Stress Corrosion Cracking."

In the LRA, the applicant stated that the Boiling Water Reactor (BWR) Stress Corrosion Cracking Program manages intergranular stress corrosion cracking (IGSCC) in reactor coolant pressure boundary components made of stainless steel. The program includes:

- Preventive measures to mitigate SCC, including IGSCC. The comprehensive program outlined in NRC Generic Letter (GL) 88-01, "NRC Position on Intergranular Stress Corrosion Cracking in BWR Austenitic Stainless Steel Piping," NUREG-0313, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," Revision 2, and in the staff-approved BWRVIP-75, "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," has been implemented. This comprehensive program addresses the mitigating measures for SCC and IGSCC. Preventive methodologies include piping replacement with IGSCC resistant stainless steel. Preventive measures have included heat sink welding, induction heating, and mechanical stress improvement. The Water Chemistry Program controls water chemistry within parameters that prevent, minimize, and mitigate IGSCC.
- Inspection and flaw evaluation to monitor SCC (including IGSCC) and its effects. The staff-approved BWRVIP-75 report allows for modifications of inspection scope in the GL 88-01 program. This program detects degradation due to SCC (including IGSCC). The BWR Stress Corrosion Cracking Program is consistent with NUREG-0313, BWRVIP-75, and GL 88-01 and its Supplement 1.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's Audit and Review Report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M7.

The staff noted that the program element for preventive actions for GALL AMP XI.M7 states that BWR water chemistry control should be performed in accordance with Boiling Water Reactor Vessel and Internals Project (BWRVIP)-29, which references the 1993 version of EPRI TR-103515, "BWR Water Chemistry Guidelines." However, the program description for the BWR Stress Corrosion Cracking Program states that the Water Chemistry Program is

based on BWRVIP-79, which references the 2000 revision of EPRI TR-103515-R2 and uses hydrogen water chemistry (HWC) to control both detrimental impurities and crack initiation and growth. This difference is addressed in the evaluation of an exception to the Water Chemistry Program, which is discussed in SER Section 3.0.3.2.1.

Operating Experience. In the LRA, the applicant stated that BSEP, as well as most of the BWR fleet of reactors, has experienced IGSCC of austenitic stainless steel piping. The implementation of the comprehensive program outlined in GL 88-01, NUREG-0313, and in the staff-approved BWRVIP-75, in conjunction with the Water Chemistry Program, has been effective in managing SCC (including IGSCC). The BWR Stress Corrosion Cracking Program has been shown to be effective at identifying the aging effect of cracking due to SCC (including IGSCC) so that repairs or replacements are implemented prior to failure.

The applicant further stated that since the implementation of this program, structural integrity has been maintained by ensuring that aging effects were discovered and repaired/replaced before the loss of intended function of the component.

The staff recognized that the Corrective Action Program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

UFSAR Supplement. In LRA Section A.1.1.4, the applicant provided the UFSAR supplement for the BWR Stress Corrosion Cracking Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.4 Aboveground Carbon Steel Tanks Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.12, "Aboveground Carbon Steel Tanks Program." In the LRA, the applicant stated that this is a new program that is consistent with GALL AMP XI.M29, "Aboveground Carbon Steel Tanks."

In the LRA, the applicant stated that the purpose of this program is to perform inspections of tanks to provide reasonable assurance that the components perform their intended function consistent with the CLB throughout the period of extended operation (see Commitment Item #8). The program manages aging effects of loss of material for external surfaces and inaccessible locations of the main fuel oil storage tank, condensate storage tanks and fire protection water storage tank. These tanks are constructed of carbon steel.

The applicant also stated that this program relies on periodic system walkdowns and inspections to monitor the condition of these tanks. This includes an assessment of the condition of tank surfaces protected by paint or coating and the caulking at the concrete foundation interface. The paint is not credited with performing a preventive function for aging management. For inaccessible surfaces, such as the tank bottom, one-time thickness measurements will be performed from inside the tank to assess the tank bottom condition. Using one-time inspections of tank bottoms ensures that degradation or significant loss of material will not occur in inaccessible locations. In addition, the condensate storage tanks and fire protection water storage tank will be subject to a one-time inspection of all interior surfaces. The Systems Monitoring Program will provide guidance to ensure that the external surfaces of the subject tanks are periodically inspected.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M29.

The staff determined that the applicant plans to rely on periodic inspections conducted in accordance with 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and the Systems Monitoring Program, which monitors tank degradation. The applicant will conduct periodic external inspections, to ensure the pressure-retaining boundary intended function is maintained, and one-time inspections of internal surfaces. The staff concluded that the applicant's Aboveground Carbon Steel Program provides reasonable assurance that the aging effects will be managed such that the tanks within the scope of the program will continue to perform their intended function consistent with the CLB throughout the period of extended operations.

Operating Experience. In the LRA, the applicant stated that for the main fuel oil storage tank, nondestructive examination (NDE) testing has been conducted on the emergency fire pump diesel fuel oil storage tank and each of the four diesel generators (DGs) 4-day fuel oil storage tanks. Problems relating to tank wall thickness degradation were not found on the subject tanks. This operating experience highlights the effectiveness of the Fuel Oil Chemistry Program in minimizing the loss of material within the fuel oil system.

The LRA also states that during inside-condensate storage tank (CST) inspections, corrosion products and coating film degradation were noted, and the shell wall thickness readings were acceptable. The shell plates have experienced negligible corrosion. On the CST bottom plates, minor corrosion indications were noted on both the Unit 1 and Unit 2 tanks and evaluated as acceptable. In addition, the exterior of each CST has been inspected. External tank surface corrosion was identified on small portions of the shell wall and evaluated as acceptable.

The LRA further states that the fire protection water storage tank inspection determined that the tank is structurally sound. The tank foundation has some minor cracking, and the interior coating has some primer degradation; both conditions have been evaluated as acceptable.

In its procedures, the applicant stated that it provides guidance for using, sharing, and evaluating operating experience at other Nuclear Generation Group (NGG) sites as well as promoting the identification and transfer of lessons learned by the industry. The staff reviewed the applicant's procedure and determined that the procedure is acceptable.

UFSAR Supplement. In LRA Section A.1.1.12, the applicant provided the UFSAR supplement for the Aboveground Carbon Steel Tanks Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.5 ASME Section XI, Subsection IWE Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.18, "ASME Section XI, Subsection IWE Program." In the LRA, the applicant stated that this is an existing program that is consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE."

In the LRA, the applicant stated that this program consists of periodic inspections of steel containment structures. The program is in accordance with the ASME Code, Section XI, Subsection IWE, 1992 Edition, with the 1992 Addenda, as modified by 10 CFR 50.55a. This program is credited for the aging management of (1) steel liners for the concrete containment and their associated integral attachments, (2) containment personnel and equipment airlocks, hatches, and drywell head, (3) seals, gaskets, and moisture barriers, (4) torus liner, downcomers, and vent header, and (5) pressure-retaining bolting.

The applicant also stated that the primary inspection method for the steel containment liner and its integral attachments is visual examination. Limited volumetric examinations utilizing ultrasonic thickness measurements are implemented as applicable.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.S1.

Operating Experience. In the LRA, the applicant stated that the ASME Section XI, Subsection IWE Program is implemented and maintained in accordance with the general requirements for

engineering programs. This provides assurance that the programs (1) are effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews; (2) have qualified personnel assigned as program managers, with authority and responsibility to implement the program; (3) have adequate resources committed to program activities; and (4) are managed in accordance with plant administrative controls.

The applicant also stated that the review of plant-specific operating experience has identified numerous assessments, performed on both a plant-specific and corporate basis, dealing with program development, effectiveness, and implementation. The ASME Section XI, Subsection IWE Program is continually being upgraded based upon industry and plant-specific experience. Additionally, plant operating experience is shared between Progress Energy sites through regular peer group meetings, a common corporate sponsor, and outage participation of program managers from other Progress Energy sites.

The staff asked the applicant to describe any augmented inspections that are currently being performed in accordance with IWE requirements. The applicant stated that the augmented inspections are located in Brunswick Nuclear Plant (BNP)-TR-002, Appendix F.

Based on review of the applicant's augmented inspection procedure and on follow-up discussions with the applicant's technical staff, the staff concluded that the applicant has appropriately considered the need for augmented inspections, in accordance with IWE requirements. The parameters monitored for the drywell and suppression chamber steel liners currently include "bulging" of the liner plate. Observation of bulging led to the past discovery of through-wall corrosion of the drywell liner plate at two locations. The applicant has repaired these locations to restore the liner to its design-basis condition. The root cause analyses for both locations concluded that the corrosion initiated from the outside surface of the liner plate, where construction debris was trapped between the liner plate and the concrete containment wall.

UFSAR Supplement. In LRA Section A.1.1.18, the applicant provided the UFSAR supplement for the ASME Section XI, Subsection IWE Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.6 10 CFR Part 50, Appendix J Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.21, "10 CFR Part 50, Appendix J Program." In the LRA, the applicant stated that this is an existing program that is consistent with GALL AMP Section XI.S4, "10 CFR Part 50, Appendix J."

In the LRA, the applicant stated that this program is structured in accordance with the requirements of 10 CFR Part 50, Appendix J, and assures the required performance-based leak testing of the containment and its penetrations. The applicant also stated that the program is the acceptable method for verifying, through testing, the management of aging effects for containment integrity as documented in the GALL Report. The 10 CFR Part 50, Appendix J Program is applicable to the leakage testing portion of aging management for the BSEP containment and its penetrations. The program is in accordance with Option B (performance-based leak testing) of 10 CFR Part 50, Appendix J and the guidelines contained in RG 1.163, September 1995, and NEI 94-01, "Industry Guideline for Implementing Performance Based Option of 10 CFR Part 50, Appendix J."

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP elements' consistency with GALL AMP XI.S4.

The GALL Report specifies that the scope of the containment leakage rate test (LRT) program include all pressure-retaining components. Type A tests are performed to measure the overall primary containment integrated leakage rate test (ILRT) and Type B tests measure local leakage rates across each pressure-containing or leakage-limiting boundary for containment penetrations. The applicant stated that the containment LRT program includes all pressure-retaining components.

The applicant stated that BSEP uses the Option B testing program, which allows a variable risk-informed testing schedule for Types A and B testing. The staff inquired whether Appendix J, Type C testing is credited for aging management for license renewal. The applicant clarified during the audit and review that 10 CFR Part 50, Appendix J, Type C, testing of containment isolation valves is also performed in accordance with Option B; however, it is not a credited aging management activity for license renewal. The staff determined that the applicant's program scope is in accordance with the GALL Report since other AMPs are credited for managing the applicable valves. The GALL Report does not require that Type C testing be credited for license renewal, provided other appropriate AMPs are credited.

The GALL Report specifies that leakage rates are to be monitored through containment shells, containment liners, and associated welds, penetrations, fittings and other access openings. The staff reviewed plant procedures, as documented in the staff's Audit and Review Report, and determined that it defines the administrative requirements and controls (test preparation, approval, performance and evaluation) for the 10 CFR Part 50, Appendix J, ILRT Option B and the ASME Section XI valve leak rate tests. The staff determined that the parameters monitored and inspected under this program are in accordance with the applicable GALL Report requirements.

As discussed in the GALL Report, leakage rate calculations do not provide indications of the initiation of aging degradation or reduced containment capacity under other types of loads

(such as seismic). The applicant stated that the primary containment inspection is a prerequisite to the ILRT and assures the early detection of aging degradation of the containment barrier. At BSEP, implementation of containment ISI is performed under ASME Section XI, Subsection IWE and ASME Section XI, Subsection IWL Programs (LRA AMPs B.2.18 and 19, respectively). The staff reviewed plant procedures and determined that they specify the primary containment inspection before ILRT performance. The staff determined that the containment testing performed under this program, in conjunction with ASME Section XI, Subsection IWE and ASME Section XI, Subsection IWL Programs, provide a program for the detection of aging effects in accordance with the GALL Report requirements. The staff also reviewed technical specification (TS) Section 5.5.12 for both units and found that it specifies when the tests shall be performed. The staffs determined that the monitoring and trending requirements are in accordance with GALL Report requirements.

The GALL Report states that acceptance rates for leakage tests are defined in the technical specifications. The applicant stated that the BSEP TS Section 5.5.12, identifies the primary containment leakage rate testing program and the leakage rate acceptance criteria. The applicant further stated that the program is in accordance with the guidelines of RG 1.163 September 1995, with the following modifications: (1) compensation for instrument accuracies applied to the primary containment leakage total is in accordance with American National Standards Institute (ANSI)/ANS 56.8-1987 instead of ANSI/ANS 56.8-1994; (2) following air lock door seal replacement, performance of door seal leakage rate testing is conducted with the gap between the door seals pressurized to 10 psig instead of air lock testing at Pa (one newton per square meter) as specified in NEI Guideline 94-01 Revision 0; (3) reduced duration Type A tests may be performed using the criteria and total time method in Bechtel Topical Report BN-TOP-1 Revision 1; (4) performance of Type C leak rate testing of the hydrogen and oxygen monitor isolation valves is not required; (5) performance of Type C leak rate testing of the main steam isolation valves is performed at a pressure less than Pa instead of leak rate testing at Pa as specified in ANSI/ANS 56.8-1994; and, (6) NEI 94-01-1995, Section 9.2.3: a one-time extension of the current 10-year Type A test interval. The staff reviewed the technical specifications for both units and determined that the above modifications are as specified for both units.

Operating Experience. In the LRA, the applicant stated that the 10 CFR Part 50, Appendix J Program is maintained in accordance with BSEP engineering program requirements. This provides assurance that (1) the program is effectively implemented to meet regulatory process and procedure requirements, including periodic reviews; (2) that qualified personnel are assigned as program managers, and are given authority and responsibility to implement the program; and (3) adequate resources are committed to program activities.

The applicant concludes that, based on review of operating history, corrective actions, and self-assessments the 10 CFR Part 50, Appendix J Program is continually monitored and enhanced to incorporate the results of operating experience as such it provides an effective means of ensuring the structural integrity and leak tightness of the containment.

The applicant stated that the results of operating experience for this program are contained in a BSEP calculation, as documented in the staff's Audit and Review Report, to document a representative sample of those operating events which validate the results of the aging effect evaluations or identify additional aging effects not previously determined by the standard method of aging management review. For this testing, the applicant concluded the following:

the expected component degradations identified through testing and inspections prompt timely corrective actions; procedure and program deficiencies were identified during routine program performance which were promptly corrected; and, program findings, weaknesses, and other items for consideration resulted in program improvements.

The staff reviewed several specific self-assessment reports as part of its review. Several program weaknesses were identified and corrected by the applicant, but no component operability concerns were noted. Based on the review of these self-assessments, the staff reviewed and determined that the applicant is adequately performing the testing required in 10 CFR Appendix J, and concludes that there is reasonable assurance that the same will continue to the period of extended operation.

UFSAR Supplement. In LRA Section A.1.1.21, the applicant provided the UFSAR supplement for the 10 CFR Part 50, Appendix J Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's 10 CFR Part 50, Appendix J Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.25, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program." In the LRA, the applicant stated that this is a new program that is consistent with GALL AMP XI.E1 (see Commitment Item #18)."

In the LRA, the applicant stated that this program is credited for aging management of cables and connections not included in the EQ Program. In addition, the applicant stated that accessible electrical cables and connections installed in adverse localized environments are visually inspected at least once every 10 years for cable and connection jacket surface anomalies.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP elements' consistency with GALL AMP XI.E1.

The staff reviewed those portions of the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program for which the applicant claims consistency with GALL AMP XI.E1 and determined that they are consistent with the GALL Report. Furthermore, the staff concluded that the applicant's electrical cables and connections not subject to 10 CFR 50.49 environmental qualification requirements program provides reasonable assurance that the intended functions of electrical cables and connections that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by heat, radiation, or moisture, will be maintained.

Operating Experience. In the LRA, the applicant stated that the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program with no operating experience history. However, as noted in the GALL Report, industry operating experience has shown that adverse localized environments caused by heat or radiation for electrical cables and connections have been shown to exist and have been found to produce degradation of insulating materials that is visually observable.

During the audit, the staff asked the applicant how operating experience is captured. The applicant indicated that a plant procedure, as discussed in the staff's Audit and Review Report, is used to increase personnel's awareness of plant and industry operating experience so that lessons learned can be used to adjust its AMP, as necessary. In its procedure, the applicant stated that it provides guidance for using, sharing, and evaluating operating experience at NGG sites as well as for promoting the identification and transfer of lessons learned from industry. The staff reviewed the applicant's procedure and determined that the procedure is acceptable.

On the basis of its review of the above industry and plant-specific operating experience and on discussions with the applicant's technical staff, the staff concludes that the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.25, the applicant provided the UFSAR supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.27, "Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program." In the LRA, the applicant stated that this is a new program that is consistent with GALL AMP XI.E3, "Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program."

In the LRA, the applicant stated that the Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is credited for managing aging cables that are not included in the EQ Program. In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested at least once every 10 years to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed. Significant moisture is defined as periodic exposures that last more than a few days (e.g., cable in standing water). Periodic exposures that last less than a few days (e.g., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than 25 percent of the time. Continuous wetting and continuous energization are not significant for medium-voltage cables that are designed for these conditions (e.g., marine cables).

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP elements' consistency with GALL AMP XI.E3.

In its basis documentation, the applicant stated that no preventive actions are required as part of the Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. Periodic actions may be taken to prevent non-EQ medium-voltage cables from being exposed to significant moisture. In addition, the applicant stated that medium-voltage cables for which such actions are taken are not required to be tested.

The staff noted that periodic actions should be taken to minimize cable exposure to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. The above action may not be sufficient to assure that water is not trapped elsewhere in the raceways. Therefore, the in-scope medium-voltage cables exposed to significant moisture and voltage should also be tested to provide an indication of the condition of the conductor insulation. The staff requested that the applicant provide the inspection frequency of the manholes and the testing frequency for the inaccessible medium-voltage cables, or provide technical justification that the inspection and testing are not necessary.

As documented in the staff's Audit and Review Report, the applicant stated that LRA Section A.1.1.27 and the UFSAR supplement will be revised to address inspection of the manholes (see Commitment Item #20). Specifically, the inspection frequency of the manholes

will be based on actual field data, and will not exceed two years. The testing of the inaccessible medium-voltage cables will be performed at least once every 10 years. The initial tests will be completed before the end of the initial 40-year license term. The staff reviewed the applicant's response and determined that it is acceptable on the basis that it is consistent with the recommendations in the GALL Report.

Operating Experience. In the LRA, the applicant stated that the inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program with no operating experience history. However, as noted in the GALL Report, industry operating experience has shown that cross-linked polyethylene (XLPE) or high molecular weight polyethylene (HMWPE) insulation materials are most susceptible to water tree formation. The formation and growth of water trees varies directly with operating voltage. Treeing is much less prevalent in 4KV cables than those operated at 13KV or 33KV. Also, minimizing exposure to moisture minimizes the potential for the development of water treeing.

During the audit, the staff asked the applicant how operating experience is captured. The applicant indicated, as documented in the staff's Audit and Review Report, that a plant procedure is used to increase personnel's awareness of plant and industrial operating experience so that lessons learned can be used to adjust its AMP, as necessary. In its procedure, the applicant stated that it provides guidance for using, sharing, and evaluating operating experience at NGG sites, as well as promoting the identification and transfer of lessons learned by the industry. The staff reviewed the applicant's procedure and determined that the procedure is acceptable.

On the basis of its review of the above industry and plant-specific operating experience, and on discussions with the applicant's technical staff, the staff concluded that the applicant's BSEP AMP B.2.27 will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.27, the applicant provided the UFSAR supplement for the Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program which states that 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 EQ Program. In-scope, medium-voltage cables exposed to significant moisture and significant voltage, as discussed in the staff's BSEP Audit and Review Report, are tested at least once every 10 years to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed.

As documented in the staff's Audit and Review Report, the applicant provided a revision to its UFSAR supplement that addresses inspection and testing for the Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. Specifically, the inspection frequency of manholes will be based on actual field data, but not to exceed two years. The testing of the inaccessible medium-voltage cables will be performed at least once every 10 years. The initial tests will be completed before the end of the initial 40-year license term.

The staff reviewed this section and determined that, with the revision, the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 Environmental Qualification (EQ) Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.3.2, "Environmental Qualification (EQ) Program." In the LRA, the applicant stated that this is an existing program that is consistent with GALL AMP X.E1, "Environmental Qualification (EQ)."

In the LRA, the applicant stated that the EQ Program manages component thermal aging, radiation aging, and cyclical aging through the use of aging 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 are to be refurbished or replaced, or have their qualification extended prior to reaching 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, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP elements' consistency with GALL AMP X.E1.

The staff concluded that the applicant's EQ Program is adequate for managing component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods.

Operating Experience. In the LRA, the applicant stated that its EQ Program has been effective at managing aging effects; operating experience has identified no age-related equipment failures that its program is intended to prevent. As stated in the GALL Report, EQ programs include consideration of operating experience to modify qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended functions during accident conditions after experiencing the effects of in-service aging. The overall effectiveness of the program is demonstrated by the

excellent operating experience for systems and components in the program. In addition, the EQ Program has been and continues to be subject to periodic internal and external assessments that effect continuous improvement.

UFSAR Supplement. In LRA Section A.1.2.3, the applicant provided the UFSAR supplement for the EQ Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.10 Summary of Conclusions for AMPs That Are Consistent With the GALL Report

During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of these AMPs are documented in the BSEP Audit and Review Report. The staff determined that these AMPs are consistent with the AMPs described in the GALL Report, including the associated operating experience attribute.

During the audit, the staff reviewed selected documents and procedures, as discussed in the staff's BSEP Audit and Review Report (ML051720621), associated with the AMPs identified above. As a result of this review, the staff identified issues for several of the AMPs that were resolved with a docketed response from the applicant. Those issues and their resolutions are discussed above.

On the basis of its review and audit of the applicant's programs, the staff found that those programs for which the applicant claims consistency with AMPs in the GALL report without exceptions or enhancements are consistent with the GALL report.

The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplements for these AMPs and found that they will provide an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPS That Are Consistent with the GALL Report with Exceptions or Enhancements

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

- Water Chemistry Program (B.2.2)
- Flow-Accelerated Corrosion Program (B.2.5)
- Bolting Integrity Program (B.2.6)
- Open-Cycle Cooling Water System Program (B.2.7)
- Closed-Cycle Cooling Water System Program (B.2.8)
- Inspection of Overhead Heavy Load and Light Load Handling Systems Program (B.2.9)
- Fire Protection Program (B.2.10)
- Fire Water System Program (B.2.11)
- Fuel Oil Chemistry Program (B.2.13)
- Reactor Vessel Surveillance Program (B.2.14)
- One-Time Inspection Program (B.2.15)
- Selective Leaching of Materials Program (B.2.16)
- Buried Piping and Tanks Inspection Program (B.2.17)
- ASME Section XI, Subsection IWL Program (B.2.19)
- ASME Section XI, Subsection IWF Program (B.2.20)
- Masonry Wall Program (B.2.22)
- Structures Monitoring Program (B.2.23)
- Protective Coating Monitoring and Maintenance Program (B.2.24)
- Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B.2.26)
- Reactor Coolant Pressure Boundary Fatigue Monitoring Program (B.3.1)

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

3.0.3.2.1 Water Chemistry Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.2, "Water Chemistry Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exceptions, with GALL AMP XI.M2, "Water Chemistry."

In the LRA, the applicant stated that the main objective of the Water Chemistry Program is to minimize loss of material, cracking, and flow blockage. The Water Chemistry Program is consistent with and relies on monitoring and control of water chemistry based on the latest version of the BWR water chemistry guidelines. This version contains guidelines for reactor

water, condensate and feedwater, for control rod drive cooling water, and other systems such as spent fuel pool water. The Water Chemistry Program includes periodic monitoring, control, and mitigation of known detrimental contaminants below the levels known to result in loss of material, cracking, and flow blockage.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP's consistency with GALL AMP XI.M2.

During the audit, the staff noted that in the AMP element for "Scope of Program," the applicant stated that the Water Chemistry Program is based on BWRVIP-79, which recommends HWC. However, the applicant stated that BSEP is a normal water chemistry plant. To clarify this discrepancy, the applicant stated, as documented in the staff's Audit and Review Report, that BSEP is an HWC plant. Therefore, the basis document will be revised to reflect this. The staff determined that the applicant's response is acceptable since the use of HWC is consistent with the recommendations in the GALL Report for the "scope of program" program element of this AMP.

In LRA Table 3.3.2-16, the applicant specifies the Water Chemistry Program and the One-Time Inspection Program for managing loss of material for the aluminum demineralized water storage tank. The staff asked the applicant to clarify how aging degradation of the aluminum demineralized water tank will be managed by the Water Chemistry Program.

As documented in the staff's Audit and Review Report, the applicant stated that BSEP AMRs have identified that the demineralized water tank is constructed of aluminum, and potentially susceptible to crevice, pitting, and galvanic corrosion. The applicant had specified the Water Chemistry AMP, augmented by the One-Time Inspection AMP, to address this aging effect. BSEP performs routine internal visual inspections of the demineralized water tank to ensure the tank is not experiencing corrosion. BSEP will credit a combination of the Water Chemistry Program and the Preventive Maintenance Program to manage these aging effects during the period of extended operation."

The staff determined that the applicant's response is acceptable on the basis that degradation in the demineralized water tank would be observed during periodic inspections through the Preventive Maintenance Program, assuring its structural integrity.

The staff noted that in LRA Table 3.3.2-7, the Water Chemistry Program is credited to manage loss of material for the standby liquid control solution storage tank. However, the sodium pentaborate solution in the tank would likely mask most of the chemistry parameters. When questioned by the staff, the applicant stated that AMRs have identified the potential for corrosion of components in the standby liquid control system (including the storage tank, piping, and valves). The standby liquid control system piping, valves, and storage tank are filled with a solution of high purity sodium pentaborate dissolved in demineralized water. While water

chemistry sampling of the standby liquid control system is limited to verifying the concentration of boron, water chemistry monitoring on the demineralized water tank does include stringent controls on parameters such as sulfates, chlorides, conductivity and suspended solids. Since the only source of water for makeup to the system is demineralized water, the benefit of chemistry controls, associated with demineralized water, are extended to the standby liquid control system. The effectiveness of these controls will be verified by implementation of the One-Time Inspection Program, consistent with the application of this program as described in GALL AMP XI.M32. Therefore, a combination of the Water Chemistry Program and One-Time Inspection Program will provide reasonable assurance that the intended functions of the components will be adequately managed for the period of extended operation.

In LRA Section B.2.2, the applicant identified the following exceptions to program elements in the GALL Report. The staff evaluation of the affected GALL Report program elements ("scope of program," "preventive actions," "parameters monitored/inspected," and "monitoring and trending") for the acceptability of the exception is as follows:

Exception 1 - Scope of Program. The GALL Report identifies the following recommendations for the "scope of program" program element associated with the exception taken:

> The program includes periodic monitoring and control of known detrimental contaminants such as chlorides, fluorides (PWRs only), dissolved oxygen, and sulfate concentrations below the levels known to result in loss of material or crack initiation and growth. Water chemistry control is in accordance with the guidelines in BWRVIP-29 (EPRI Report TR-103515) for water chemistry in BWRs; EPRI TR-105714, Rev. 3, for primary water chemistry in PWRs; EPRI TR-102134, Rev. 3, for secondary water chemistry in PWRs; or later revisions or updates of these reports as approved by the staff.

Exception: Though the GALL Report recommends that water chemistry be controlled in accordance with BWRVIP-29 (references the 1993 revision of EPRI Report TR-103515, "BWR Water Chemistry Guidelines"), the Water Chemistry Program is based on the latest version of the BWRVIP Water Chemistry Guidelines (currently BWRVIP-79, which references EPRI Report TR-103515-R2, "BWR Water Chemistry Guidelines," February 2000).

EPRI incorporates new information to develop proactive plant-specific water chemistry programs to minimize IGSCC. EPRI periodically updates the water chemistry guidelines as new information becomes available. The applicant stated that its Water Chemistry Program will be updated as revisions to the guidelines are released. The staff found EPRI TR-103515-R2 acceptable because the program is based on updated industry experience and plant-specific and industry-wide operating experience confirms the effectiveness of the Water Chemistry Program.

The applicant further stated that a review of in-vessel visual examination reports was performed and acceptable results were observed during recent inspections. For example, a crack in jet pump riser "G" RS-1 weld was examined during outages B113R1, B114R1, and B115R1 with no discernible growth noted. Similar results have been found in the examination of other reactor vessel internals components, such as the core spray sparger piping. Also, inspections performed on piping components associated with GL 88-01 (NRC Position on IGSCC in BWR austenitic stainless steel piping), as modified by BWRVIP-75, have also had good results.

The applicant stated that as revisions to the guidelines are released, the Water Chemistry Program will be updated to develop a more proactive program that minimizes age-related degradation.

During the audit, the staff determined that the applicant's response is acceptable since it is consistent with the recommendations provided in the EPRI-recommended HWC program, which is an enhancement to the Water Chemistry Program recommended by the GALL Report. Therefore, the staff concluded that this exception is acceptable.

Exception 2 - Preventive Actions. The GALL Report identifies the following recommendations for the "preventive actions" program element associated with the exception taken:

> The program includes specifications for chemical species, sampling and analysis frequencies, and corrective actions for control of reactor water chemistry. System water chemistry is controlled to minimize contaminant concentration and mitigate loss of material due to general, crevice and pitting corrosion and crack initiation and growth caused by SCC. For BWRs, maintaining high water purity reduces susceptibility to SCC.

Exception: The Water Chemistry Program is additionally credited with managing loss of material due to galvanic corrosion and flow blockage due to fouling.

In the LRA, certain AMRs credit this program for mitigating loss of material due to galvanic corrosion or flow blockage due to fouling. Galvanic corrosion is managed using the same methods applied for crevice corrosion, general corrosion, pitting corrosion, and SCC. The parameter limits in effect are based on the latest version of the BWR water chemistry guidelines. These parameters include, but are not limited to, chloride, specific conductivity, sulfate, nitrite, tolyltriazole, dissolved oxygen, and silica. Operation below these parameter limits helps to control electrolytes. In total, these controls have been shown by operating experience to have been effective in minimizing each form of electrochemical corrosion, including galvanic corrosion, pitting corrosion, crevice corrosion, general corrosion, and SCC. Flow blockage due to fouling is managed by controlling the creation of corrosion products.

During the audit, the staff asked the applicant to explain how the Water Chemistry Program manages flow blockage due to fouling in certain components. The applicant stated that flow blockage is managed by minimizing the creation of corrosion products. The Water Chemistry Program has been credited for managing flow blockage due to fouling for the core spray nozzles (in combination with the Reactor Vessel and Internals Structural Integrity Program) and the control rod drive (CRD) hydraulic control unit filters (in combination with the One-Time Inspection Program). The basis for crediting the Water Chemistry Program is that this program monitors and controls parameters such as level of contaminants, conductivity, and pH. Control of these parameters serves to inhibit the formation of corrosion products. These corrosion products, in the form of rust, scale, or particles, have the potential to foul filters and spray nozzles; therefore, preventing the formation of corrosion products is an effective means to manage this potential aging effect. The applicant stated that previous inspections of these components have shown that the Water Chemistry Program is effective in managing this aging effect.

The staff reviewed and determined that the applicant's response is acceptable on the basis that controlling the buildup of corrosion products decreases the potential for fouling of nozzles and

filters, and past inspections of these components have indicated no fouling problems. Therefore, the staff concluded that this exception is acceptable.

Exception 3 - Parameters Monitored/Inspected. The GALL Report identifies the following recommendations for the "parameters monitored/inspected" program element associated with the exception taken:

> The concentration of corrosive impurities listed in the EPRI guidelines discussed above, which include chlorides, fluorides (PWRs only), sulfates, dissolved oxygen, and hydrogen peroxide, are monitored to mitigate degradation of structural materials. Water quality (pH and conductivity) is also maintained in accordance with the guidance. Chemical species and water quality are monitored by in process methods or through sampling. The chemistry integrity of the samples is maintained and verified to ensure that the method of sampling and storage will not cause a change in the concentration of the chemical species in the samples.
>
> BWR Water Chemistry: The guidelines in BWRVIP-29 (EPRI TR-103515) for BWR reactor water recommend that the concentration of chlorides, sulfates, and dissolved oxygen are monitored and kept below the recommended levels to mitigate corrosion. The two impurities, chlorides and sulfates, determine the coolant conductivity; dissolved oxygen, hydrogen peroxide, and hydrogen determine electrochemical potential (ECP). The EPRI guidelines recommend that the coolant conductivity and ECP are also monitored and kept below the recommended levels to mitigate SCC and corrosion in BWR plants. The EPRI guidelines in BWRVIP-29 (TR-103515) for BWR feedwater, condensate, and control rod drive water recommends that conductivity, dissolved oxygen level, and concentrations of iron and copper (feedwater only) are monitored and kept below the recommended levels to mitigate SCC. The EPRI guidelines in BWRVIP-29 (TR-103515) also include recommendations for controlling water chemistry in auxiliary systems: torus/pressure suppression chamber, condensate storage tank, and spent fuel pool.

Exception: The Water Chemistry Program does not require the monitoring of hydrogen peroxide, which is included in the description section of GALL AMP XI.M2.

During the audit, the staff asked the applicant to explain the impact of not monitoring hydrogen peroxide on the effectiveness of program, and how the electrochemical potential of the water will be determined. In response, the applicant stated that reliable hydrogen peroxide data are exceptionally difficult to obtain. Decomposition of hydrogen peroxide to water and oxygen in reactor coolant sample lines is very rapid and BSEP has no data with regard to locations where radiation is sufficient to generate additional hydrogen peroxide resulting in significant steady state concentrations.

The applicant further stated that electrochemical potential (ECP) values can be calculated using verified computer models, such as the BWRVIP radiolysis/ECP model, and can be directly correlated with measurements of other plant parameters (oxygen, main steam line radiation levels, etc.). Computer simulation of water radiolysis can describe concentrations of hydrogen peroxide in the various parts of the BWR primary circuit and in the main steam. The BWRVIP radiolysis/ECP model has proven to be effective in determining plant water chemistry conditions. The model has been evaluated and developed over a decade. Model simulations

have been performed for BWRs and are in excellent agreement with reliable chemistry measurements obtained from steam and recirculation piping. The model contains predictive models for radiolysis, and ECP is the measure of the oxidizing environment. The output is region-by-region predictions for the concentration of oxidizing species in the coolant and the ECP. BSEP uses a radiolysis model to estimate the hydrogen peroxide. BWRVIP-79, Section 5.2.1.13, allows such use of models to estimate hydrogen peroxide and hence the determination of the ECP.

Although hydrogen peroxide is not monitored, the ECP is calculated using the predictive radiolysis models and can be used to determine concentrations of hydrogen peroxide in the water. Therefore, the staff concluded that this exception is acceptable.

Exception 4 - Monitoring and Trending. The GALL Report identifies the following recommendations for the "monitoring and trending" program element associated with the exception taken:

> The frequency of sampling water chemistry varies (e.g., continuous, daily, weekly, or as needed) based on plant operating conditions and the EPRI water chemistry guidelines. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions.

Exception: The latest version of the BWR Water Chemistry Guidelines may specify slightly different sampling frequencies than those specified in BWRVIP-29.

The staff found EPRI TR-103515-R2 acceptable because the program is based on updated industry experience. The applicant stated that BSEP and industry-wide operating experience confirms the effectiveness of the Water Chemistry Program.

The applicant's response for Exception 1, above, also pertains to this exception. The staff determined that this exception is acceptable since the applicant has been following the recommendations given in the EPRI-recommended HWC program, which is an enhancement to the Water Chemistry Program recommended by the GALL Report.

Operating Experience. In the LRA, the applicant stated that the EPRI guideline documents have been developed based on plant experience and have been shown to be effective over time with their widespread use in the industry. The specific examples of BWR industry operating experience are as follows: (1) IGSCC has occurred in small- and large-diameter BWR piping made of austenitic stainless steels and nickel-based alloys; (2) significant cracking has occurred in piping welds of recirculation, core spray, residual heat removal, and reactor water cleanup systems; (3) IGSCC has also occurred in a number of vessel internal components, including the core shroud, access hole cover, top guide, and core spray spargers; and (4) no occurrence of SCC in piping and other components in standby liquid control systems exposed to sodium pentaborate solution has ever been reported.

The applicant also stated that the operating experience at BSEP is similar to that of the industry. Cracking due to IGSCC was found in reactor recirculation, reactor water cleanup, and jet pump instrumentation system piping; however, under the BWR Stress Corrosion Cracking

Program, appropriate preventive measures were implemented to mitigate IGSCC in these systems.

The applicant's operating experience review in the LRA bases document for the Water Chemistry Program states that this program is continually upgraded based on industry experience and research. These continuous improvements are to assure the capability of the Water Chemistry Program to support the safe operation of BSEP throughout the extended period of operation. Also, after implementing HWC in the late 1980s, and zinc injection in mid-1990s, the applicant has observed no such degradation in these systems.

On the basis of its review of the above industry and plant-specific operating experience and on discussions with the applicant's technical staff, the staff concluded that the applicant's Water Chemistry Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.2, the applicant provided the UFSAR supplement for the Water Chemistry Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.2 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.5, "Flow-Accelerated Corrosion Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exception and enhancement, with GALL AMP XI.M17, "Flow-Accelerated Corrosion."

In the LRA, the applicant stated that this program provides for prediction, inspection, and monitoring of piping and fittings for a loss of material aging effect due to FAC so that timely and appropriate action may be taken to minimize the probability of experiencing a flow-accelerated corrosion (FAC)-induced consequential leak or rupture. The FAC Program elements are based on the recommendations identified in NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program," which requires controls to assure the structural integrity of carbon steel lines containing high-energy fluids (two phase as well as single phase). The FAC Program manages loss of material in carbon steel piping and fittings.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the

BSEP Audit and Review Report. The staff reviewed the exception and enhancement and the associated justifications to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP's consistency with GALL AMP XI.M17.

In the LRA, the applicant stated the following exception and enhancement to the program elements listed for GALL AMP XI.M17.

Exception - Scope of Program. The GALL Report identifies the following recommendation for the "scope of program" program element associated with the exception taken:

> The FAC program, described by the EPRI guidelines in NSAC-202L-R2, includes procedures or administrative controls to assure that the structural integrity of all carbon steel lines containing high-energy fluids (two phase as well as single phase) is maintained. . . . The NSAC-202L-R2 (April 1999) provides general guidelines for the FAC program. To ensure that all the aging effects caused by FAC are properly managed, the program includes the use of a predictive code, such as CHECWORKS, that uses the implementation guidance of NSAC-202L-R2 to satisfy the criteria specified in 10 CFR Part 50, Appendix B, criteria for development of procedures and control of special processes.

Exception: NSAC-202L-R2 advises that portions of systems and water-containing components greater than 200°F can be excluded from further FAC susceptibility evaluation if they contain superheated steam with no moisture content. The FAC susceptibility analyses allow for the exclusion of components operating with superheat or with a steam quality exceeding 99.5 percent from further susceptibility evaluation. Typical BWR steam qualities are in excess of 99.5 percent, but some moisture is present.

FAC susceptibility analyses predate issuance of NSAC-2002L-R2. Experience with FAC modeling has shown that piping with high steam quality (>99.5 percent) yields very low predicted wear rates (<1.5 mils/year) and very high estimated remaining life projections. This exception reduces the amount of steam system piping modeled explicitly with CHECWORKS, but does not alter the primary inspection focus in accordance with NSAC-202L-R2.

As discussed in the staff's Audit and Review Report, the applicant provides general directions for implementing the EPRI guidelines in NSAC-202L-R2, including conducting an analysis to determine critical locations, performing limited baseline inspections to determine the extent of thinning at these locations, and performing follow-up inspections to confirm the predictions, or repairing components as necessary. The EPRI guidelines in NSAC-202L-R2 state that portions of systems with water-containing components greater than 200°F can be excluded from further FAC susceptibility evaluation if they contain superheated steam with no moisture content. BSEP cautions analysts not to use the results of a CHECWORKS ranking analysis as absolute values. The component predictive results can be used to establish a component's susceptibility relative to another component, but should not be used on a quantitative basis to determine a specific wear rate or specific service life.

The staff determined that the piping eliminated from the CHECWORKS model would remain in the FAC Program and could be selected for inspection as part of the FAC Program implementation Plan. The staff determined that excluding piping, which may contain moisture, from the CHECWORKS model is standard industry practice. Therefore, the staff concluded that this exception is acceptable on the basis that it will not degrade the information provided by CHECWORKS and the piping being eliminated would have high estimated remaining life projections.

On the basis of its review of the above exception, and on discussions with the applicant's technical staff, the staff concluded that the exception stated by the applicant for the Flow-Accelerated Corrosion Program to the program elements for GALL AMP XI.M17 are acceptable.

Enhancement - Scope of Program. The GALL Report identifies the following guidance for the "scope of program" program element associated with the enhancement.

> The FAC program, described by the EPRI guidelines in NSAC-202L-R2, includes procedures or administrative controls to assure that the structural integrity of all carbon steel lines containing high-energy fluids (two phase as well as single phase) is maintained. Valve bodies retaining pressure in these high-energy systems are also covered by the program.

Enhancement: Update the FAC susceptibility analyses to include additional components potentially susceptible to FAC.

In the FAC Program implementation plan, the applicant described the process for identifying components, potentially susceptible to FAC, that were removed from the FAC inspection program on the basis of susceptibility analyses. Prior to the period of extended operation, the applicant will use the systems elimination calculation to identify these additional components (see Commitment Item #2).

The staff reviewed the enhancement and determined that extending FAC Program inspections to components with lower FAC susceptibility will provide additional assurance that aging effects are identified prior to component failures.

On the basis of its review of the program elements, and on discussions with the applicant's technical staff, the staff concluded that those program elements in the FAC Program for which the applicant claims consistency with GALL AMP XI.M17 are consistent with the GALL Report.

Operating Experience. In the LRA, the applicant stated that wall-thinning problems in single-phase systems have occurred throughout the industry in feedwater and condensate systems, and in two-phase piping in extraction steam lines and moisture separator reheater and feedwater heater drains. The high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) steam drain lines have experienced wall thinning due to FAC. The FAC Program was originally outlined in NUREG-1344 and implemented through GL 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning." The program has evolved through industry experience and is now described in NSAC-202L-R2. Application of the FAC Program has resulted in replacement of piping identified as being subject to FAC before experiencing a

consequential leak or rupture. The FAC Program has provided an effective means of ensuring the structural integrity of high-energy carbon steel systems.

The applicant stated that the current FAC Program is an outgrowth of the applicant's response to GL 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning." Since its inception, this program has evolved based on industry best practices, self-assessment, and NRC inspections. The applicant had previously observed significant, but localized, erosion on the internal surfaces of several carbon steel valve bodies which was resolved through the applicant's Corrective Action Program. The affected safety-related (SR) valves were the 24-inch residual heat removal/low pressure coolant injection (RHR/LPCI) system injection and 16-inch suppression pool isolation valves as described in Information Notice (IN) 89-01, "Valve Body Erosion." This erosion was attributed to throttling the valves too far in the closed position, but not to FAC.

On the basis of its audit, the staff determined that from 1994 to 1996 three corrective action reports identified multiple through-wall failures. From 1996 to present, three corrective action reports identified multiple wall degradations that required repair or replacement. In 1994, a single through-wall leak was identified in a component that is in the FAC Program. The staff determined that the FAC Program has been effective in reducing the number of through-wall leaks.

UFSAR Supplement. In LRA Section A.1.1.5, the applicant provided the UFSAR supplement for the FAC Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's FAC Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exception and the associated justifications, and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. Also, the staff has reviewed the enhancement and confirmed that the implementation of the enhancement prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 Bolting Integrity Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.6, "Bolting Integrity Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exceptions and enhancement, with GALL AMP XI.M18, "Bolting Integrity."

In the LRA, the applicant stated that this 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 which considers material

properties, joint/gasket design, chemical control, service requirements, and industry/site operating experience in specifying torque and closure requirements. The program relies on recommendations for a Bolting Integrity Program, as delineated in NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," and industry recommendations, as delineated in EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," and TR-104213, "Bolted Joint Maintenance & Application Guide," for pressure-retaining bolting within the scope of license renewal. While the AMP discussion reconciles structural bolting issues presented in the GALL Report for the sake of completeness, this AMP does not prescribe aging management of structural bolting.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exceptions and enhancement and the associated justifications to determine whether the AMP, with the exceptions and enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP's consistency with GALL AMP XI.M18.

Exception 1 - Scope of Program. The GALL Report identifies the following recommendation for the "scope of program" program element associated with the exception taken.

> The program covers all bolting within the scope of license renewal including safety-related bolting, bolting for NSSS component supports, bolting for other pressure retaining components, and structural bolting. The program covers both greater than and smaller than 2-in. diameter bolting. The Nuclear Regulatory Commission (NRC) staff recommendations and guidelines for comprehensive bolting integrity programs that encompass all safety-related bolting are delineated in NUREG-1339. The industry's technical basis for the program for safety related bolting and guidelines for material selection and testing, bolting preload control, inservice inspection (ISI), plant operation and maintenance, and evaluation of the structural integrity of bolted joints, are outlined in EPRI NP-5769, with the exceptions noted in NUREG 1339. For other bolting, this information is set forth in EPRI TR-104213.

Exception: The Bolting Integrity Program is not utilized to address aging management requirements for structural bolting. Structural bolting is discussed herein only in response to specific issues raised by the GALL Report in its Bolting Integrity Program description. Implementation of aging management requirements for structural bolting is accomplished under the ASME Section XI, Subsection IWF Program and the Structures Monitoring Program.

Exception 2 - Parameters Monitored/Inspected. The GALL Report identifies the following recommendation for the "parameters monitored/inspected" program element associated with the exception taken.

> The aging management program (AMP) monitors the effects of aging on the intended function of closure bolting, including loss of material, cracking, and loss of preload. High strength bolts (actual yield strength $\geq$ 150 ksi) used in NSSS component supports are monitored for cracking. Bolting for pressure retaining components is inspected for signs

of leakage. Structural bolting is inspected for indication of potential problems including loss of coating integrity and obvious signs of corrosion, rust, etc.

Exception: The Bolting Integrity Program is not utilized to prescribe monitoring and trending for bolting within the ASME Section XI boundaries. These activities are addressed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The Bolting Integrity Program is not utilized to address aging management requirements for structural bolting. Structural bolting is discussed herein only in response to specific issues raised by the GALL Report in its Bolting Integrity Program description. Implementation of aging management requirements for structural bolting is accomplished under the ASME Section XI, Subsection IWF Program and the Structures Monitoring Program.

Exception 3 - Detection of Aging Effects. The GALL Report identifies the following recommendation for the "detection of aging effects" program element associated with the exception taken.

> Inspection requirements are in accordance with the American Society of Mechanical Engineers (ASME) Section XI, Table IWB 2500-1 or IWC 2500-1 (1995 edition through the 1996 addenda) and the recommendations of EPRI NP-5769. For Class 1 components, Table IWB 2500-1, examination category B-G-1, for bolting greater than 2 in. in diameter, specifies volumetric examination of studs and bolts and visual VT-1 examination of surfaces of nuts, washers, bushings, and flanges. All high strength bolting used in nuclear steam supply system (NSSS) component supports are to be inspected also to the requirements for Class 1 components, examination category B-G-1. Examination category B-G-2, for bolting 2 in. or smaller requires only visual VT-1 examination of surfaces of bolts, studs, and nuts. For Class 2 components, Table IWC 2500-1, examination category B-D, for bolting greater than 2 in. in diameter, requires volumetric examination of studs and bolts. Examination categories B-P or C-H require visual examination (IWA-5240) during system leakage testing of all pressure-retaining Class 1 and 2 components, according to Tables IWB 2500-1 and IWC 2500-1, respectively. In addition, degradation of the closure bolting due to crack initiation, loss of prestress, or loss of material due to corrosion of the closure bolting would result in leakage. The extent and schedule of inspections, in accordance with IWB 2500-1 or IWC 2500-1, assure detection of aging degradation before the loss of the intended function of the closure bolting. Structural bolting both inside and outside containment is inspected by visual inspection. Degradation of this bolting may be detected and measured either by removing the bolt, proof test by tension or torquing, by in situ ultrasonic tests, or hammer test. If this bolting is found corroded, a closer inspection is performed to assess extent of corrosion.

Exception: The Bolting Integrity Program is not utilized to prescribe acceptance criteria for bolting within Section XI boundaries. These activities are addressed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The Bolting Integrity Program is not utilized to address aging management requirements for structural bolting, including nuclear steam supply system supports. Structural bolting is discussed herein only in response to specific issues raised by the GALL Report in its Bolting Integrity Program description. Implementation of aging management requirements for structural bolting is accomplished under the ASME Section XI, Subsection IWF Program and the Structures Monitoring Program.

Exception 4 - Monitoring and Trending. The GALL Report identifies the following recommendation for the "monitoring and trending" program element associated with the exception taken.

> The inspection schedules of ASME Section XI are effective and ensure timely detection of cracks and leakage. If bolting for pressure retaining components (not covered by ASME Section XI) is reported to be leaking, then it may be inspected daily. If the leak rate does not increase, the inspection frequency may be decreased to weekly or biweekly.

Exception: Inspections of Section XI bolting is performed under the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, and not addressed in the Bolting Integrity Program. The Bolting Integrity Program does not specify leakage monitoring requirements for components outside Section XI boundaries.

The staff reviewed the above exceptions and considered them to represent a major inconsistency between the Bolting Integrity Program and GALL AMP XI.M18. During the audit, the staff requested that the applicant clarify the program to address monitoring and trending for bolting outside ASME Section XI boundaries, and the specific activities included in the scope of this AMP. In response, the applicant stated that there is considerable overlap between activities described in GALL AMP XI.M18 for the Bolting Integrity Program and those of the GALL AMP XI.M1, "ASME Section XI, Subsections IWB, IWC, and IWD Program," and the GALL AMP XI.S3, "ASME Section XI, Subsection IWF Program." Other activities described in GALL AMP XI.M18 are addressed in BSEP plant-specific programs for systems monitoring and structures monitoring.

Monitoring and trending for bolting inside Section XI boundaries is monitored by the ASME Section XI, Subsections IWB, IWC and IWD Program (pressure boundary bolting) and the ASME Section XI Subsection IWF Program (structural bolting), as applicable. Similarly, monitoring and trending for bolting outside Section XI boundaries is addressed by the Systems Monitoring Program or Structures Monitoring Program. The BSEP approach is to credit the Bolting Integrity Program for activities specific to bolting (torquing methodology, chemical requirements for thread lubricants/sealants, etc.) and address activities already encompassed in other AMPs within those programs. Information and bases regarding specific activities crediting other AMP's is provided in the discussion of program elements in BSEP procedures as discussed in the Audit and Review Report.

The staff reviewed BSEP documentation, as discussed in the staff's Audit and Review Report, and determined that it provides information and bases regarding specific activities crediting other AMPs. Based on a review of the applicant's response, the staff determined that the applicant appropriately manages aging of structural bolting, including bolting for NSSS component supports, by implementing the ASME Section XI, Subsection IWF Program and Structures Monitoring Program. Pressure-retaining bolting within the boundaries of the ASME Section XI is also appropriately managed by this AMP, in combination with the ASME Section XI, Subsections IWB, IWC, and IWD Program, and Systems Monitoring Program.

With regard to the applicant's exception to the program element for monitoring and trending, the staff asked the applicant to clarify the activities it uses to monitor leakage for pressure-retaining bolting outside the ASME Section XI boundaries. In its response, the applicant stated

that the plant procedure used to implement the Systems Monitoring Program is based on guidance in EPRI Technical Report TR-107668, "Guideline for System Monitoring by System Engineers." This procedure requires that inspections be performed on a frequency sufficient to identify age-related degradation prior to loss of function, and includes criteria for inspections of bolted connections and for system leakage. Deficiencies noted are subject to the Corrective Action Program, which ensures that the deficiency is addressed based on its implications on plant safety, reliability, and quality.

The staff reviewed the applicant's response and requested information on the leakage inspection frequency used and how it compares to the recommendations in the GALL Report. The applicant stated that EPRI Report TR-107688 does not recommend a set frequency for leakage inspections. Instead, monitoring is based on consideration of a range of criteria, including criticality of the system/component, consequences of failure, operating experience, etc. Comparison of the EPRI recommendations with the recommendations in the GALL Report shows consistency since the GALL Report also does not specify a fixed frequency for leakage inspections.

Additionally, as part of its audit of the AMRs for the ESF systems in LRA Section 3.2, the staff asked for clarification on the Bolting Integrity Program as it relates to pressure-retaining bolting. The applicant committed to revising the Bolting Integrity Program to include the ASME inservice inspection requirements, along with monitoring and trending activities for pressure-retaining bolting outside the boundaries of ASME Section XI (see Commitment Item #3). This commitment will obviate the need for several of the exceptions stated above for this program.

Based on the applicant's response, the staff concluded that the applicant appropriately manages the pressure-retaining bolting outside the ASME Section XI boundaries by this AMP in combination with the Systems Monitoring Program. These programs provide reasonable assurance that this class of bolting in systems outside the ASME Section XI boundaries will maintain the pressure boundary function.

On the basis of its review of the above exceptions, the applicant's responses to audit questions, and discussions with the applicant's technical staff, the staff concluded that the exceptions stated by the applicant for the Bolting Integrity Program to the program elements for AMP GALL XI.M18 are acceptable.

Enhancement - Preventive Actions. The GALL Report recommends the following criterion for the "preventive actions" program element associated with the enhancement:

> Selection of bolting material and the use of lubricants and sealants is in accordance with the guidelines of EPRI NP-5769 and the additional recommendations of NUREG-1339 to prevent or mitigate degradation and failure of safety-related bolting (see item 10, below). (NUREG-1339 takes exception to certain items in EPRI NP-5769, and recommends additional measures with regard to them.) Initial ISI of bolting for pressure retaining components includes a check of the bolt torque and uniformity of the gasket compression after assembly. It is noted that hot torquing of bolting is a leak preventive measure once the joint is brought to operating temperature and before or after it is pressurized. Hot torquing thus reestablishes preload before leak starts, but is ineffective in sealing a leak once it has begun.

Enhancement. A precautionary note will be added to plant bolting guidelines to limit the sulfur content of compounds used on bolted connections.

The staff reviewed this enhancement and determined that it is acceptable on the basis that it will provide additional assurance that improper lubricants and sealants are not used.

On the basis of its review of the above enhancement, the staff concluded that the exceptions and enhancement stated by the applicant for the Bolting Integrity Program to the program elements for GALL AMP XI.M18 are acceptable.

Operating Experience. In the LRA, the applicant stated that this program is based on industry guidance that considers operating experience. BSEP operating experience includes verification of fastener material properties in accordance with NRC Bulletin 87-02, "Fastener Testing to Determine Conformance With Applicable Material Specifications," issued on November 6, 1987, including sample-based testing, which verified that A193, B7 bolting material specifications were not only within manufacturer's specifications, but also well below the 150 ksi threshold associated with cracking.

The applicant also stated that the operating experience review shows that its Bolting Integrity Program is continually upgraded based on industry experience, research, and routine program performance. The program, through its continual improvement, assures the capability of mechanical bolting to support the safe operation of BSEP throughout the extended period of operation.

UFSAR Supplement. In LRA Section A.1.1.6, the applicant provided the UFSAR supplement for the Bolting Integrity Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Bolting Integrity Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications, and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the staff has reviewed the enhancement and confirmed that the implementation of the enhancement prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Open-Cycle Cooling Water System Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.7, "Open-Cycle Cooling Water System Program." In the LRA, the applicant stated that this is an existing program that is consistent, with enhancements, with GALL AMP XI.M20, "Open-Cycle Cooling Water System."

In the LRA, the applicant stated that this program relies on implementation of the recommendations of GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," to ensure that the effects of aging on the Open-Cycle Cooling Water (OCCW) (or service water) System Program will be managed for the extended period of operation. The program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the OCCW system or structures and components serviced by the OCCW System Program.

The OCCW System Program addresses portions of the service water (SW) systems of Units 1 and 2. The program scope includes SR portions of both the nuclear and conventional SW headers. The OCCW portion of the RHR service water, diesel generator heat exchangers and associated SW piping/components, and other SR heat loads cooled by the SW system are also included within the scope of license renewal. Additionally, the program is credited with aging management of limited nonsafety-related (NSR) piping and components included within the scope of license renewal. Specifically, this includes the SW discharge header, and piping/components associated with cooling water to and from the reactor building closed cooling water (RBCCW) heat exchangers.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP's consistency with GALL AMP XI.M20.

The applicant stated that to ensure that the effects of aging on the OCCW system will be managed for the extended period of operation, the program relies on implementation of the recommendations of the NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment." At BSEP, requirements and implementing documents associated with various elements of Generic Letter 89-13 are contained in Engineering Procedure 0ENP-2704, "Administrative Control of NRC Generic Letter 89-13 Requirements."

The staff reviewed those portions of the OCCW System Program, which the applicant claims is consistent with GALL AMP XI.M20, and found that they are consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's OCCW System Program acceptable because it conforms to the recommended GALL AMP.

In the LRA, the applicant stated the following enhancements to the OCCW System Program for consistency with the recommendations in the GALL Report.

Enhancement 1 - Scope of Program. The GALL Report identifies the following guidance for the "scope of program" program element associated with the enhancement:

> Because the characteristics of the service water system may be specific to each facility, the OCCW system is defined as a system or systems that transfer heat

from safety related systems, structures, and components (SSC) to the ultimate heat sink (UHS). If an intermediate system is used between the safety-related SSCs and the system rejecting heat to the UHS, that intermediate system performs the function of a service water system and is thus included in the scope of recommendations of NRC GL 89-13.

Enhancement: The scope of the OCCW System Program will include portions of the SW system credited in the AMR, including RBCCW piping, discharge piping to the weir, and piping to and from diesel generators (including expansion joints).

To ensure that the effects of aging on the OCCW system will be managed for the extended period of operation, the program relies on implementation of the recommendations of the NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment." Although the OCCW System Program was originally developed in response to GL 89-13, the scope of the GALL AMP is broader than the applicant's current licensing commitments to GL 89-13. For example, the GL 89-13 program extends to the SR boundary on the discharge piping exiting the reactor building; whereas, the scope of the OCCW System Program extends well past this boundary, including the balance of piping in the reactor building, as well as the discharge flow path through the turbine building to its exit at the discharge weir.

As a result, the scope of the existing OCCW System Program requires an enhancement to assure piping and components that are within the scope of license renewal under 10 CFR 54.4(a)(2) are addressed by the existing GL 89-13 program. The applicant stated that this enhancement will be integrated into an engineering procedure which governs the GL 89-13 program as discussed in the staff's Audit and Review Report.

During the audit, the applicant stated that the expansion of inspection scope over that prescribed by GL 89-13 is generally that part of the system beyond SR boundaries and within the scope of license renewal. The major portions of the system in this category are identified in the program description, as noted above. Namely, these are the discharge flow paths outside the reactor building, RBCCW supply and return piping, and the diesel generator SW system. Note that the latter is safety related, but not specifically addressed in the GL 89-13 program.

The applicant further stated that, relative to the OCCW System Program description in LRA Appendix B not specifically including the reactor building heating, ventilating, and air conditioning (HVAC) system, the program descriptions in LRA Appendices A and B are general descriptions, not intended to be at a level of detail that would provide a comprehensive representation of all the systems affected by the program. This level of detail, provided in the LRA Section 3 tables and LRA Table 3.3.2-22, correctly represents coils in the emergency core cooling system (ECCS) pump room coolers as managed by the OCCW System Program.

The staff reviewed the applicant's response and determined that this enhancement is acceptable on the basis that it provides additional assurance that the effects of aging to piping and components will be adequately managed.

Enhancement 2 - Parameters Monitored/Inspected. The GALL Report identifies the following guidance for the "parameters monitored/inspected" program element associated with the enhancement:

> Cleanliness and material integrity of piping, components, heat exchangers, and their internal linings or coatings (when applicable) that are part of the OCCW system or that are cooled by the OCCW system are periodically inspected, monitored, or tested to ensure heat transfer capabilities.

Enhancement: Inspections will include locations where throttling or changes in flow direction might result in erosion of copper-nickel piping.

In BNP-LR-602, the applicant stated that its operating experience review has identified erosion of OCCW system piping/components associated with throttling. Specifically, erosion has been noted in NSR piping adjacent to the throttle valves where SW exits the reactor buildings, and at flow orifice plates on the line from the RHR SW booster pump motor coolers. Both of these locations are in NSR piping, which was outside the scope of the GL 89-13 program.

Prior to the period of extended operation, the applicant committed to enhance the program to require that inspections include locations where throttling of changes in flow direction might result in erosion of copper-nickel piping (see Commitment Item #4). The applicant will identify inspection locations before each outage based on operating experience, based on a review of system design by engineering personnel, and based on results of previous inspections. Guidance for selecting inspection locations will be integrated into program procedures on an ongoing basis.

The staff determined that this enhancement is acceptable on the basis that such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3 - Detection of Aging Effects. The GALL Report identifies the following guidance for "detection of aging effects" program element associated with the enhancement:

> Detection of aging effects should occur before there is loss of any structure and component intended function. 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. Inspections for biofouling, damaged coatings, and degraded material condition are conducted. Visual inspections are typically performed; however, nondestructive testing, such as ultrasonic testing, eddy current testing, and heat transfer capability testing, are effective methods to measure surface condition and the extent of wall thinning associated with the service water system piping and components, when determined necessary.

Enhancement: The following enhancements will be provided: (1) The RHR heat exchangers will be subject to eddy current testing; (2) verification of SW pump lube oil cooler flow and heat transfer effectiveness and replacement of RHR seal coolers will be incorporated into procedures; and, (3) inspection of a representative sample of SW pump casings will be performed (see Commitment Item #4).

In BNP-LR-602, the applicant stated that piping within the scope of license renewal of this AMP is regularly inspected for evidence of biofouling, silting, and corrosion. SW pumps, strainers, and heat exchangers are periodically disassembled and/or flushed, as appropriate. To achieve

consistency with this GALL Report element, the applicant stated that, prior to the extended period of operation, the RHR heat exchangers will be subject to eddy current testing, a representative sampling of the SW pump casings will be inspected, and SW pump lube oil cooler flow and heat transfer effectiveness will be proceduralized in the OCCW System Program.

Based on a review of operating experience, the applicant determined that the RHR seal coolers require replacement each outage (every 2 years) to address corrosion concerns. Prior to the period of extended operation, the applicant committed to incorporate the requirements for replacement of RHR seal coolers into plant procedures (see Commitment Item #4). There are currently plant modifications planned to replace the current design with materials proven to be compatible with its service environment. Additionally, these coolers represent a low point in the system and would require inspection and cleaning every four years even if the corrosion concerns were addressed. Therefore, the procedural requirement will be to replace the coolers every two years, noting that this can be extended to four years on the basis of implementing the aforementioned plant modifications

The staff reviewed and determined that the applicant's response is acceptable since it clarifies the intended actions related to the RHR coolers, and they are appropriate. On the basis of its review, the staff reviewed and determined that the enhancements described above provide additional assurance that the effects of aging in the OCCW system will be adequately managed and are, therefore, acceptable.

Enhancement 4 - Monitoring and Trending. The GALL Report identifies the following recommendations for the "monitoring and trending" program element associated with the enhancement:

> Inspection scope, method (e.g., visual or nondestructive examination [NDE]), and testing frequencies are in accordance with the utility commitments under NRC GL 89-13. Testing and inspections are done annually and during refueling outages. Inspections or nondestructive testing will determine the extent of biofouling, the condition of the surface coating, the magnitude of localized pitting, and the amount of [microbiologically influenced corrosion] MIC, if applicable. Heat transfer testing results are documented in plant test procedures and are trended and reviewed by the appropriate group.

Enhancement: The RHR heat exchanger eddy current test results will be compared to previous baseline testing to determine material condition and need for ongoing monitoring.

In the LRA, the applicant stated that inspection scope, method (e.g., visual or NDE), and testing frequencies are in accordance with the utility commitments under GL 89-13. Inspections and testing are performed to manage biofouling, the condition of the surface coating, and localized pitting, and will identify the presence of MIC, if applicable. Heat exchanger performance is verified by regular inspections and cleaning. The applicant committed to compare RHR heat exchanger eddy current test results with previous test results to establish material condition and ascertain ongoing monitoring requirements (see Commitment Item #4).

The staff noted that the LRA credits the performance of regular inspections and cleaning in lieu of the recommendation in the GALL Report to document test results of the heat transfer

capability of heat exchangers. Although the LRA credits regular inspections and cleaning in lieu of testing, the staff noted that the program implementing procedure specifies that testing of the capabilities of the RHR and emergency diesel generator jacket water heat exchangers would be performed and documented. The staff asked the applicant to clarify the apparent inconsistency between the implementing procedure and the OCCW System Program, as described in its LRA.

As documented in the staff's Audit and Review Report, the applicant stated that the OCCW System Program will be revised to include performance testing of the RHR and emergency diesel generator jacket water heat exchangers prior to the period of extended operation. The results from these testing activities will then be evaluated and used to prescribe testing/inspection requirements needed to ensure system functionality during the period of extended operation.

On the basis of its review of the program elements, and on discussions with the applicant's technical staff, the staff concluded that those program elements in OCCW System Program for which the applicant claims consistency with GALL AMP XI.M20 are consistent, with enhancements, with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that a review of recent system operating history shows that the OCCW System Program has been effective in identifying and mitigating leaks, as well as preventing equipment failures related to fouling and flow blockage. In addition, the applicant stated that a review of plant and industry operating experience has identified localized erosion of system components in throttling applications, corrosion, and silting of RHR seal coolers, and corrosion and fouling of RHR pump strainers, as items of concern. Requirements for addressing these issues are formalized in the OCCW System Program.

During the audit, the applicant stated that inspection locations will be identified each outage based on operating experience, review of system design by engineering personnel, and results of previous inspections. Guidance for selecting inspection locations will be integrated into program procedures on an ongoing basis. In addition, BSEP Procedure 0ENP-2704 is the program procedure for the GL 89-13 program. This requirement and other elements of the license renewal OCCW System Program will be integrated into that program document.

The applicant also stated that, regarding the adequacy of the current program, the license renewal OCCW System Program and the GL 89-13 program are related, but different, programs. The GL 89-13 program pertains to a defined and auditable scope based on BSEP's current licensing commitments to GL 89-13. The license renewal OCCW System Program is based on a GALL Report program description, which relies on GL 89-13, but has a broader scope that includes NSR components meeting the requirements of 10 CFR 54.4(a)(2). For example, the GL 89-13 program extends to the SR boundary on the discharge piping exiting the reactor building. The OCCW System Program scope extends well past this boundary, including the balance of piping in the reactor building as well as the discharge flow path through the turbine building to its exit at the discharge weir. The enhancements described in the LRA pertain to the license renewal OCCW System Program, not necessarily to the GL 89-13 program.

The applicant also stated that enhancements to the license renewal OCCW System Program either involve components that are outside the GL 89-13 program or are activities that already are being done and are being formalized in a program document to meet specific

implementation/documentation requirements prescribed by the OCCW System Program. While consideration may be given to including these items in the GL 89-13 program, the current program is not deficient. Where deficiencies are identified, site and corporate processes include an ongoing Corrective Action Program and continuous quality improvement. Relative to operating experience with erosion, the applicant noted erosion in piping downstream of the throttle valves where SW exits the reactor buildings, and at flow orifice plates on the line from the RHR SW booster pump motor coolers. Both these locations are in NSR piping outside the scope of the current GL 89-13 program. Inspection requirements for both locations will be formalized in the integrated program document to satisfy license renewal requirements.

The applicant's response is acceptable since it presents a reasonable approach for locating erosion due to throttling, and demonstrates that past operating experience has adequately detected such erosion.

Also, the applicant stated that plant-specific operating experience has been captured by a review of the action tracking database and the Maintenance Rule (MR) database.

Implementing procedures were selected for review by the staff as discussed in the staff's Audit and Review Report. These stipulate that relevant site and industry operating experience be considered in the determination of anticipated aging effects and the effectiveness of required programs.

In addition to the above reviews, equipment within the OCCW System Program are subject to ongoing reviews and assessments. The process for identifying, documenting, tracking, investigating, correcting, and trending conditions adverse to quality is described in the Corrective Action Program procedure. During the period of November 3 to November 7, 2003 and November 17 to November 21, 2003, the adequacy of this program was reviewed by a team of NRC inspectors. As documented in its report (NRC Inspection Reports: IR 05000325/2003-009 and 05000324/2003-009), the applicant's process for identifying problems and entering them into the Corrective Action Program was effective. In addition, the applicant properly prioritized issues, performed technically accurate evaluations, and developed and implemented corrective actions that were appropriate for the safety-significance of the issue.

UFSAR Supplement. In LRA Section A.1.1.7, the applicant provided the UFSAR supplement for the OCCW System Program, which states that the aging effects of material loss and fouling due to micro- or macro-organisms and various corrosion mechanisms, are addressed by programs that include monitoring, inspecting, and testing to verify heat transfer, and provide assurance that aging effects for the open-cycle cooling water systems can be managed for an extended period of operation.

Prior to the period of extended operation, the program will be enhanced to ensure that (1) the program scope includes portions of the SW system credited in the AMR, including NSR piping; (2) the RHR heat exchangers will be subject to eddy current testing with results compared to previous testing to evaluate degradation and aging; (3) a representative sampling of SW pump casings will be inspected; (4) program procedures will be enhanced to include verification of cooling flow and heat transfer effectiveness of SW pump oil cooling coils, inspections associated with SW flow to the DGs (including inspection of expansion joints), and inspection and replacement criteria for RHR seal coolers; and, (5) piping inspections will include locations where throttling or changes in flow direction might result in erosion of copper-nickel piping.

Following incorporation of this enhancement, the OCCW System Program will be consistent with the corresponding program described in the GALL Report.

As documented in the staff's Audit and Review Report, by letter dated March 14, 2005, the applicant committed to revise the OCCW System Program to include performance testing of the RHR and emergency diesel generator jacket water heat exchangers prior to the period of extended operation (see Commitment Item #4). The results from these testing activities will then be evaluated and used to prescribe testing and inspection requirements needed to ensure system functionality during the period of extended operation.

The staff reviewed this section and determined that, with the addition of the applicant's commitment to complete performance testing of the RHR and emergency diesel generator (EDG) jacket water heat exchangers, the USAR supplement provides an adequate summary description as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's OCCW System Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff has reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Closed-Cycle Cooling Water (CCCW) System Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.8, "Closed-Cycle Cooling Water System Program." In the LRA, the applicant stated that this is an existing program that is consistent, with enhancements, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System."

In the LRA, the applicant stated that this program addresses aging management of components in the RBCCW and DG jacket water cooling systems. These systems are closed cooling loops with controlled chemistry, consistent with the GALL Report description of a CCCW system. The program relies on maintenance of system corrosion inhibitor concentrations within specified limits of EPRI TR-107396, "Closed Cooling Water Chemistry Guideline," to minimize corrosion. Surveillance testing and inspection in accordance with standards in EPRI TR-107396 for CCCW systems is performed to evaluate system and component performance. These measures will ensure that the CCCW system and components serviced by the CCCW system are performing their functions acceptably.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP's consistency with GALL AMP XI.M21.

In addition, the staff reviewed a selected sample of BSEP implementing procedures, as documented in the staff's Audit and Review Report, which incorporate the guidelines of EPRI TR-107396 and provide chemistry control parameters and corrective actions to be performed if a specific parameter is exceeded.

In the LRA, the applicant stated that the CCCW System Program addresses aging management of components in the RBCCW and DG jacket water cooling systems. The RBCCW and EDG jacket water cooling systems are closed cooling loops with controlled chemistry, consistent with the description of a CCCW system in the GALL Report. These systems use demineralized water and a chemical corrosion inhibitor.

In the LRA, the applicant stated the enhancements to the program elements to be consistent with the recommendations in the GALL Report.

Enhancement 1 - Parameter Monitored/Inspected - The GALL Report identifies the following guidance for the "parameter monitored/inspected" program element associated with the enhancement:

> The aging management program (AMP) monitors the effects of corrosion by surveillance testing and inspection in accordance with standards in EPRI TR-107396 to evaluate system and component performance. For pumps, the parameters monitored include flow and discharge and suction pressures. For heat exchangers, the parameters monitored include flow, inlet and outlet temperatures, and differential pressure.

Enhancement: External inspections will be performed on cooling fins and surfaces of the DG combustion air intercoolers for corrosion or fouling.

In the LRA, the applicant stated that testing and inspections of the DG jacket water cooling water heat exchangers are performed regularly, as prescribed by the OCCW System Program. The diesel generator combustion air intercoolers are regularly tested as a part of the diesel generators. Testing of the NSR RBCCW system heat exchangers is not required on a prescribed basis. However, since this system is in the scope of license renewal only for spatial interaction considerations, heat transfer is not critical to support its license renewal intended function.

The DG is subjected to an array of preventive maintenance (PM) activities that include disassembly and inspection of heat exchangers, and other critical components exposed to the DG jacket water cooling water. The applicant commits to enhancing current PM activities to include external inspections of cooling fins and surfaces of the DG combustion air intercoolers for corrosion or fouling (see Commitment Item #5).

The efficacy of CCCW system chemistry in preventing corrosion (including pitting and crevice corrosion) is supported by the condition of system components upon disassembly and the lack of site-specific Operating experience regarding corrosion in system components. The applicant

stated that its operating experience review found no incidence of age-related degradation associated with the DG jacket water system.

During the audit, the staff determined that the above enhancement to include visual inspection of cooling fins and surfaces of the intercoolers provides assurance that the effects of aging to components that are within the scope of license renewal will be adequately managed and, therefore, is acceptable.

Enhancement 2 - Detection of Aging Effects. The GALL Report identifies the following guidance for the "detection of aging effects" program element associated with the enhancement:

> Control of water chemistry does not preclude corrosion at locations of stagnant flow conditions or crevices. Degradation of a component due to corrosion would result in degradation of system or component performance. The extent and schedule of inspections and testing in accordance with EPRI TR-107396, assure detection of corrosion before the loss of intended function of the component. Performance and functional testing in accordance with EPRI TR-107396, ensures acceptable functioning of the CCCW system or components serviced by the CCCW system. For systems and components in continuous operation, performance adequacy is determined by monitoring data trends for evaluation of heat transfer fouling, pump wear characteristics, and branch flow changes. Components not in operation are periodically tested to ensure operability.

Enhancement: PM activities will include inspections of DG combustion air intercoolers and heat exchangers. These activities will ensure that applicable potential aging effects are identified.

The DGs and DG jacket water cooling system are not normally in service but are closely monitored during regular testing for trends indicative of degraded performance. In the LRA, the applicant stated that the DGs are tested regularly as required by plant technical specifications. The DG jacket water cooling system is regularly tested as part of the DG and inspected regularly under the open-cycle cooling water system and PM programs.

The DG is subjected to an array of PM activities that include disassembly and inspection of heat exchangers, and other critical components exposed to the DG jacket water cooling water. The DG combustion air intercoolers are regularly tested as a part of the DGs. In the LRA, the applicant commits to enhancing PM activities to include external inspections of combustion air intercoolers (see Commitment Item #5).

The applicant stated that the CCCW system chemistry has been effective in preventing corrosion (including pitting and crevice corrosion) and that this conclusion is supported by the condition of system components upon disassembly and the lack of site-specific operating experience regarding corrosion in system components.

The staff determined that this enhancement is acceptable on the basis that it provides assurance that the effects of aging to components that are within the scope of license renewal will be adequately managed.

On the basis of its review of the above enhancements, review of selected documents as documented in the staff's Audit and Review Report, and on discussions with the applicant's

technical staff, the staff concluded that the enhancements stated by the applicant for the CCCW System Program to the program elements for GALL AMP XI.M21 are acceptable.

Operating Experience. Degradation of closed-cycle cooling water systems due to corrosion product buildup (NRC Licensee Event Report [LER] 50-327/93-029-00) or through-wall cracks in supply lines (NRC LER 50-280/91-019-00) has been observed in operating plants.

The applicant stated that, since the GALL Report is based on industry operating experience through April 2001, more recent industry operating experience has been reviewed for applicability. Subsequent operating experience will be captured through the normal operating experience review process.

In the LRA, the applicant stated that an operating experience review found no incidence of age-related degradation associated with the CCCW systems. RBCCW operating experience at BSEP includes SW-related (tubeside) fouling and corrosion or plugging of the RBCCW heat exchanger tubes. Since these components are within the scope of license renewal for spatial interaction only, the shell performs an intended function, and tube degradation does not impact the scope of AMRs. Moreover, aging management of raw water components is performed by the OCCW system. BSEP operating experience review found no incidence of age-related degradation associated with the DG jacket water system.

During the audit, the staff also reviewed the results of a BSEP self-assessment of the CCCW System Program. The objective of this assessment was to ensure that the BSEP chemistry unit closed cooling water activities are conducted in accordance with applicable procedures, guidelines, and regulatory compliance. The applicant performed the evaluation during the period of November 4 to 8, 2002, and included the RBCCW and the DG jacket water systems. As documented in the BSEP Report described in the staff's Audit and Review Report, an evaluation performed in May 2001 by the Institute of Nuclear Power Operations determined that the applicant was not effectively evaluating chemistry parameters to identify trends that may lead to out of specification conditions in the closed-cooling water systems. To address and correct this issue, the applicant completed Adverse Condition Investigation (AR 44704) in July 2001. The staff found that the 2002 self-assessment concluded that the CCCW System Program ensures that chemistry parameters are maintained within specifications. The applicant stated that the operating experience review of the CCCW System Program is continually upgraded based on site and industry experience and research.

UFSAR Supplement. In LRA Section A.1.1.8, the applicant provided the UFSAR supplement for the Closed-Cycle Cooling Water System Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's CCCW System Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff has reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff

also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Inspection of Overhead Heavy Load and Light Load Handling Systems Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.9, "Inspection of Overhead Heavy Load and Light Load Handling Systems Program." In the LRA, the applicant stated that this is an existing program that is consistent, with enhancement(s), with GALL AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

In the LRA, the applicant stated that this program provides for the inspection of the reactor building bridge cranes, refueling platforms, and the intake structure gantry crane. The inspections monitor structural members for the absence or signs of corrosion other than minor surface corrosion and crane rails for abnormal wear. The inspections are performed annually for the reactor building bridge cranes and the intake structure gantry crane, and every fuel cycle for the refueling platforms. The diesel generator building cranes do not credit this program for aging management activities, because they are addressed as structural steel (monorails) and managed under the Structures Monitoring Program.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP's consistency with GALL AMP XI.M23.

On the basis of its audit and discussions with the applicant, the staff determined that the Inspection of Overhead Heavy Load and Light Load Handling Systems Program is implemented through procedures and work order packages. BSEP's standard procedure, as documented in the staff's BSEP Audit and Review Report, provides guidance for implementing the Inspection of Overhead Heavy Load and Light Load Handling Systems Program and describes the scope of the program. Monitoring and trending are not required as part of the Inspection of Overhead Heavy Load and Light Load Handling Systems Program. BSEP's PM procedures provide directions for condition monitoring of specific cranes and delineate the frequencies of the maintenance inspections. The frequency of inspections is consistent with industry practice.

Work packages provide directions concerning the parameters monitored or inspected, the detection of aging effects, and the associated acceptance criteria. The acceptance criterion for structural members is the absence of signs of corrosion other than minor surface corrosion. The acceptance criterion for crane rails is the absence of abnormal wear.

The applicant assessed the load cycle limits for cranes that are within the scope of license renewal using TLAAs. The applicant concluded that the analyses of the cranes have been

projected to the end of the period of extended operation. The staff documented its evaluation of these TLAAs in SER Section 4.7.3.

In the LRA, the applicant stated that the following enhancements will be implemented to make this AMP consistent with the recommendations in the GALL Report.

Enhancement 1 - Scope of Program. The GALL Report identifies the following guidance for the "scope of program" program element associated with the enhancement.

> The program manages the effects of general corrosion on the crane and trolley structural components for those cranes that are within the scope of 10 CFR 54.4 and the effects of wear on the rails in a rail system.

Enhancement: The applicant will revise administrative controls to include all cranes within the scope of license renewal, not only the SR cranes (see Commitment Item #6).

On the basis of its evaluation of the applicant's existing program and planned enhancement, the staff determined that there is reasonable assurance that the enhanced program will adequately manage the aging effects for all cranes within the scope of license renewal during the period of extended operation.

Enhancement 2 - Parameters Monitored/Inspected. The GALL Report identifies the following guidance for the "parameters monitored/inspected" program element associated with the enhancement.

> The program evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes. The number and magnitude of lifts made by the crane are also reviewed.

Enhancement: The applicant will revise administrative controls to require maintenance to forward completed inspection reports to the responsible engineer (see Commitment Item #6).

During the audit, the staff determined that the enhancement to the administrative process will provide additional assurance that the responsible engineer will receive and evaluate maintenance monitoring information pertinent to the aging effects on long-lived passive components associated with cranes that are within the scope of license renewal. On the basis of its evaluation of the applicant's existing program and planned enhancement, the staff determined that there is reasonable assurance that the responsible engineers will receive completed inspection reports.

Enhancement 3 - Detection of Aging Effects. The GALL Report identifies the following guidance for the "detection of aging effects" program element associated with the enhancement.

> Crane rails and structural components are visually inspected on a routine basis for degradation. Functional tests are also performed to assure their integrity.

Enhancement: The applicant will revise administrative controls to address the following: (1) include in the program all cranes within the scope of license renewal; (2) specify an annual inspection frequency for the reactor building bridge cranes and the intake structure gantry crane, and every fuel cycle for the refuel platforms; (3) allow use of maintenance crane inspections as

input for the condition monitoring of license renewal cranes; and (4) include inspection of structural component corrosion and monitoring crane rails for abnormal wear (see Commitment Item #6).

The applicant stated that it plans to revise its procedure to include all cranes within the scope of license renewal, rather than just the SR cranes; include inspecting crane rails for abnormal wear; specify an inspection frequency of every refueling cycle for the refuel platforms and an annual inspection frequency for the other cranes; and, allow the use of maintenance crane inspection results as input to the condition monitoring of license renewal cranes. The applicant also stated that its maintenance procedures, as discussed in the staff's Audit and Review Report, will be revised to include inspection of structural components for corrosion and to specifically address corrosion of structural components and cane rail wear.

During the audit, the staff determined that the enhancements provide changes to implementing procedures that will result in the inspection of Overhead Heavy Load and Light Load Handling Systems Program being consistent with the associated AMP in the GALL Report. On the basis of its evaluation of the applicant's existing program and planned enhancements, the staff determined that there is reasonable assurance that aging effects will be managed.

On the basis of its review of the above enhancements, program elements, and on discussions with the applicant's technical staff, the staff concluded that the enhancements stated by the applicant for the Inspection of Overhead Heavy Load and Light Load Handling Systems Program to the program elements for GALL AMP XI.M23 are acceptable.

Operating Experience. In the LRA, the applicant stated that based on review of plant history, BSEP has identified numerous issues involving corrosion of structural members, crane rail wear, operations, inspections, and regulatory compliance through a review of the corrective action process. Crane monitoring programs are continually being upgraded based upon industry and Progress Energy plant experience. This intrusive and proactive approach to the operation and management of cranes verifies the effectiveness of those procedures used to implement the inspection of Overhead Heavy Load and Light Load Handling Systems Program.

The applicant identified several corrective action reports associated with cranes, as documented in the staff's Audit and Review Report, which showed that adverse conditions are identified and corrected. These corrected deficiencies included: (1) underside of the intake structure crane end trucks severely corroded; (2) Unit 2 refuel bridge tracks not straight, level, or parallel with respect to each other; (3) documentation of operations inspections of refuel bridge needed to be revised to meet the daily/shift crane inspection requirements per ANSI B30.2-1976, Chapter 2-2 and NUREG-612 Section 5.1.1, AR 67768; and, (4) extreme buildup of metal shavings rest on the overhead crane tracks due to wear on tracks.

The staff reviewed the Adverse Condition Investigation Form, which concerned the finding of severe corrosion on the underside of the intake structure crane end trucks. The applicant used ultrasonic tests (UTs) to assess the structural integrity of the end trucks. The UT results indicated that the wall thickness exceeded the nominal thickness. The applicant cleaned and painted the crane end trucks. Additional inspections by the applicant verified the absence of material degradation. The staff determined that the applicant's corrective actions taken in response to identified aging degradation were effective in managing the degradation.

UFSAR Supplement. In LRA Section A.1.1.9, the applicant provided the UFSAR supplement for the Inspection of Overhead Heavy Load and Light Load Handling Systems Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Inspection of Overhead Heavy Load and Light Load Handling Systems Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff has reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Fire Protection Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.10, "Fire Protection Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exception(s), with GALL AMP XI.M26, "Fire Protection."

In the LRA, the applicant stated that this program is credited for aging management of the fire protection components (penetration seals, barrier walls, ceiling and floors, and fire doors, gaseous (Halon/CO_2) fire suppression systems, the diesel-driven fire pump fuel oil supply line, and the fire pump diesel engine heat exchanger. The applicant also states that this program is implemented through various plant procedures and is proven to adequately manage the aging effects associated with the subject components.

As stated in UFSAR Section 9.5.1, the Fire Protection Program consists of design features, equipment, personnel, and procedures that combine to provide for a multi-tiered safeguard against a fire that could impact the health and safety of the public. The objectives of the Fire Protection Program are to minimize both the probability and consequences of postulated fires. The plant's Fire Hazards Analysis (FHA) evaluates the construction, occupancy, and protection for all major areas of the plant and includes an assessment of the ability of fire protection features to safeguard the components (including power, control, and instrumentation) needed to safely shut down the plant. Plant modifications, which have the potential to impact the FHA, are reviewed as part of the design change process and the UFSAR is updated as necessary.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP's consistency with GALL AMP XI.M26.

The applicant stated that the Fire Protection Program is staffed by qualified personnel with adequate resources committed to program activities and managed in accordance with plant administrative controls. The program ensures the maintenance of necessary fire prevention and mitigation features through periodic inspections and performance testing. All relevant parameters observed during scheduled testing and inspection, and during routine work activities, are recorded. Discrepancies thus identified which affect the fire protection components (penetration seals, barrier walls, ceiling and floors, and fire doors), gaseous (Halon/CO_2) fire suppression systems, and the diesel-driven fire pump fuel oil supply line, are then further evaluated and trended to allow timely and appropriate corrective action.

The applicant further stated that based on its review of operating history data and assessment results, the Fire Protection Program has provided an effective means of ensuring the preservation from fire of the safe shutdown capability of BSEP, and through its continual improvement, is assured of the capability to support the safe operation of BSEP throughout the extended period of operation.

In the LRA, the applicant stated the following exceptions to the program elements listed in the GALL Report.

Exception 1 - Parameters Monitored/Inspected and Detection of Aging Effects The GALL Report identifies the following specifications for the "parameters monitored/inspected" and "detection of aging effects" program elements associated with the exception taken:

> Visual inspection of penetration seals detects cracking, seal separation from walls and components, and rupture and puncture seals. Visual inspection (VT-1 or equivalent) of 10 percent of each type of penetration seal in walkdowns at least every refueling outage.

Exception: The penetration seal sample size utilized by BSEP is less than the GALL Report recommended sample size of 10 percent. However, based on plant operating history, the sample provides reasonable assurance the entire population is adequately monitored. Additionally, NRC Interim Staff Guideline (ISG)-04, as discussed in the staff's Audit and Review Report, has modified the GALL recommendation to a sample size of approximately 10 percent.

The applicant stated that a visual inspection of a statistical sample of fire barrier penetration seals every 18 months is mandated by procedure. The sample is selected based on building seal population utilizing a multiple sampling program with an acceptable quality level of 96 percent in accordance with ANSI/ASQC Z1.4-1993. Based on inspection results, the scope of inspection is expanded to include additional seals. The sample size of penetration seal inspections during each inspection interval may, depending on the number of discrepancies found, be greater or less than 10 percent. The applicant further stated that the visual inspections are conducted in accordance with established procedures and inspection criteria is sufficient to detect any indication of cracking, seal separation from walls and components, and rupture and puncture of seals. Since the sample size is not 10 percent as recommended in the GALL Report, the applicant has identified its inspection sample process as an exception to the GALL Report.

Fire barrier penetration seals are passive elements in the facility Fire Protection Program. Maintaining their functional integrity ensures that fires will be confined or adequately retarded

from spreading to adjacent portions of the facility, thereby minimizing the possibility of a single fire rapidly involving several areas of the facility prior to detection and extinguishment.

The Fire Protection Program is controlled by procedure. In addition to establishing the administrative control requirements of the Fire Protection Program, the staff's review of this procedure found it to require periodic surveillance of fire protection systems and features and that these surveillances are documented in and implemented through plant procedures.

Operability, action, and surveillance requirements for fire barrier penetrations are established by procedure. As described in the procedure, a statistical sample of penetration seals in each affected building (or group of buildings) is visually inspected every 18 months. The selection sample is to be based on building seal population utilizing a multiple sampling program in accordance with ANSI/ASQC Z1.4-1993, "Sampling Procedures and Tables for Inspection by Attributes," with an acceptable quality level of 96 percent. Section 6.6.4 of this procedure further states that periodic surveillance of fire barrier penetrations using a statistical sampling method has been determined to be acceptable.

Procedures, as discussed in the staff's Audit and Review Report, are provided to ensure that the fire barrier penetration seals (fire seals) for cables, conduit, piping, ventilation ducts, fire dampers, and wall/floor fire barriers in the diesel generator building SR areas are functional. The inspection scope and frequency is expanded if an unacceptable number of seals are found to be degraded. The staff determined that these measures ensure timely detection of increased hardness and shrinkage of penetration seals before there is a loss of component intended function. No unpredicted aging unique to the BSEP materials, service conditions, or environments has been yet been identified.

During the audit, the staff asked the applicant for additional information on the technical basis for its sampling method. In its response, the applicant stated that, under its statistical sampling procedure, acceptability is based on a predetermined acceptable quality level factor of 4 which means 96 of every 100 seals are functional. This factor was used since it falls within the range judged acceptable for low safety significant systems, has been evaluated, and provides reasonable assurance that the aging of subject components will be managed. In addition, the applicant stated that a review of past surveillance results found that failures are individual, isolated problems and not the general or common mode failure of any one type of seal. Also, plant operating experience has demonstrated that penetration seal failure has not been prevalent.

The staff noted that the inspection sample size is not in strict compliance with the recommendations in the GALL Report; however, it is based on established statistical sampling methods contained in ANSI/ASQC Z1.4-1993 "Sampling Procedures and Tables for Inspection by Attributes." Also, the sample size is consistent with ISG-04, which requires a sample size of approximately 10 percent, since the applicant stated that the sampling selection methodology provides a sample size which may be greater or less than 10 percent. In addition, visual inspections are conducted in accordance with established procedures, and inspection criteria appear to be sufficient to detect any indication of cracking, seal separation from walls and components, and rupture and puncture of seals.

As evidenced by the applicant's review of operational history, the sampling techniques and surveillance procedures currently employed provide reasonable assurance that the fire barrier penetration systems will perform their intended functions during the period of extended operation.

On the basis of its review, the staff determined that the above exception is acceptable.

Exception 2 - Parameters Monitored/Inspected and Detection of Aging Effects The GALL Report identifies the following specifications for the "parameters monitored/inspected" and "detection of aging effects" program elements associated with the exception taken:

> Visual inspection of penetration seals detects cracking, seal separation from walls and components, and rupture and puncture seals. Visual inspection (VT-1 or equivalent) of 10% of each type of penetration seal in walkdowns at least every refueling outage.

Exception: The Fire Protection Program does not require visual inspection of each type of penetration seal but rather a statistical sampling of penetration seals in each affected building (or group of buildings). However, this sampling method is determined to be both acceptable for the BSEP configuration and adequate to assure the capability of the penetration seals to preserve the fire safe shutdown capability. Based on the sampling process and frequency of inspections, a representative sampling is assured.

The applicant stated that a visual inspection of a statistical sampling of fire barrier penetration seals every 18 months is mandated by procedure 0PLP-01.2, "Fire Protection System Operability, Action, and Surveillance Requirements." The sample is selected based on building seal population utilizing a multiple sampling program with an acceptable quality level of 96 percent in accordance with ANSI/ASQC Z1.4-1993. On the basis of inspection results, the scope of the inspection may be expanded to include additional seals. The applicant further stated that the visual inspections are conducted in accordance with established procedures, and inspection criteria is sufficient to detect any indication of cracking, seal separation from walls and components, and rupture and puncture of seals. Inspection acceptance criteria are provided for various penetration types and include shrinkage, cracking, gaps, and seal intact; they are structured to verify operability of the penetration seals. The subject inspection criteria are adequate to identify penetration seal degradation and are consistent with those identified by this program element.

As discussed above, the staff reviewed implementing procedures. Visual inspections are conducted in accordance with established procedures and inspection criteria appear to be sufficient to detect any indication of cracking, seal separation from walls and components, and rupture and puncture of seals. No unpredicted aging unique to the BSEP materials, service conditions, or environments have been yet been identified.

As evidenced by the operational history data, the sampling techniques and surveillance procedures currently employed provide reasonable assurance that the fire barrier penetration systems will perform their intended functions during the period of extended operation. On the basis of its review, the staff determined that the above exception is acceptable.

Exception 3 - Parameters Monitored/Inspected and Detection of Aging Effects. The GALL Report identifies the following guidance for the "parameters monitored/inspected" and "detection of aging effects" program elements associated with the exception taken:

> Periodic visual inspection and functional test at least once every six months examines the signs of degradation of the halon/carbon dioxide fire suppression

system. The suppression agent charge pressure is monitored in the test. Inspections performed at least every month to verify that the extinguishing agent supply valves are open and the system is in automatic mode.

Exception: ISG-04 modified the GALL Report program element to recommend system functional testing at least once every six months for the Halon/CO_2 fire suppression system. The subject systems are verified as being properly charged every six months, but functional testing is performed less frequently. The Halon system is functionally tested annually and the CO_2 system is functionally tested every 18 months. Although these are less frequent than specified by the GALL Report, testing is sufficient to ensure the systems will perform their intended functions, as evidenced by the operational history of the systems. The BSEP gaseous suppression system functional testing procedures include the program element's specified operability criteria. Furthermore, the specific frequency of gaseous suppression system functional testing has proven, based on operating experience, to be adequate to assure the continued capability of the systems to preserve from fire the safe shutdown capability of BSEP.

By letter dated June 17, 2002, the staff received written comments from the NEI on the fire protection system programs described in the July 2001 GALL Report. To address these comments and provide clarification of staff positions, by letter dated December 3, 2002, the staff issued ISG-04, "Aging Management of Fire Protection Systems for License Renewal." In its cover letter the staff stated that it considers this ISG as providing clarifications, with no additional requirements, and plans to incorporate the information it contains into the improved license renewal guidance documents in a future update scheduled for late 2005. In ISG-04, the NRC staff stated that:

> The staff reviewed these items and determined that a valve lineup inspection, charging pressure inspection, and an automatic mode of operation verification are operational activities pertaining to system or component configurations or properties that may change, and are not related to aging management. Therefore, the staff position is to revise NUREG-1801 to eliminate the Halon/carbon dioxide system inspections for changing pressure, valve lineups, and automatic mode of operation.

On the basis of its review and discussions with the applicant, the staff determined that the above exception is acceptable since it is consistent with guidance provided in ISG-04.

Exception 4 - Detection of Aging Effects. The GALL Report identifies the following recommendation for the "parameters monitored/inspected" program element associated with the exception taken:

> Periodic visual inspection and function test at least once every six months examines the signs of degradation of the halon/carbon dioxide fire suppression system.

Exception: General visual inspections, rather than a VT-1 or equivalent inspection, are performed for the subject components. However, the applicable inspection criteria are sufficient to assure detection of aging effects for the components.

In the LRA, the applicant stated that the Halon system is functionally tested annually, and the CO_2 system is functionally tested every 18 months. The BSEP gaseous suppression system functional

testing procedures include the program element's specified operability criteria. Furthermore, the specific frequency of gaseous suppression system functional testing has proven, based on operating experience, to be adequate to assure the continued capability of the systems to preserve from fire the safe shutdown capability of BSEP.

The staff reviewed the Fire Protection System procedure which outlines the operability, action, and surveillance requirements for fire protection systems at BSEP, including the CO_2 and Halon systems, as documented in the staff's Audit and Review Report. The procedure requires that the minimum specified weight of CO_2 be verified every six months. In addition, the CO_2 system control heads, and associated ventilation dampers, are verified every 18 months to actuate manually and automatically, as appropriate, upon receipt of a simulated actuation signal. To assure no blockage, flow testing through the CO_2 flooding system headers and nozzles is performed every 18 months. With regard to the Halon system, the procedure requires verification every six months that the Halon cylinders contain at least the minimum specified liquid level and both the Halon and nitrogen supply cylinders are maintained at the minimum specified pressures. The applicant stated that both systems are functionally tested to ensure operability of manual and automatic actuation features, free flow of the suppression agents, valve and damper response.

Additionally, the applicant stated that, since Halon and CO_2 gases do not contribute to corrosion or other aging mechanisms, a six-month inspection frequency is not required to manage aging. As noted on LRA Table 3.3.2-12, no AERMs are expected for Halon and CO_2 system components exposed to these gases. The applicant further stated that in accordance with the National Fire Protection Association (NFPA) requirements, Halon and CO_2 inspection procedures include periodic visual inspections and functional tests every 18 months to inspect for signs of degradation of the fire suppression systems. The staff determined that the applicant's response is acceptable since aging effects are not expected for the Halon and CO_2 system.

UFSAR Section 9.5.1.3.4 states that administrative controls for inspection and testing of suppression systems are provided through existing plant administrative procedures, plant operating procedures, and the quality assurance program to ensure that the Fire Protection Program and equipment are properly maintained. After installation, fire protection equipment and systems are subject to an inspection and acceptance test in accordance with the NFPA codes, Nuclear Electric Insurance Limited Members Manual, and plant procedures. After the system is in operation, periodic inspections and tests are conducted, as defined by the Fire Protection Program, Nuclear Electric Insurance Limited Members Manual, and NFPA codes.

Although the inspections and tests are less frequent than those recommended in the GALL Report, the staff determined that the current program frequency is sufficient to ensure that the systems will perform their intended functions, as evidenced by the operational history of the systems. Any degradation or mechanical damage would be observed during the test. On the basis of its review of operating experience for the Fire Protection Program, discussed below, the staff determined that this exception is acceptable.

On the basis of its review of the program elements, and on discussions with the applicant's technical staff, the staff concluded that those program elements in Fire Protection Program for which the applicant claims consistency with GALL AMP XI.M26 are consistent with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that the program is maintained in accordance with BSEP requirements for engineering programs. This provides assurance that the program is effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews; qualified personnel are assigned as program managers, and are given authority and responsibility to implement the program; and adequate resources are committed to program activities.

The applicant also stated that the operating history and assessment results for the program show it is an effective means of ensuring the preservation from fire of the safe shutdown capability. Since these measures assure continual improvement of the program as prompted by industry experience, research, and routine program performance, the capability of the Fire Protection Program to support the safe operation of BSEP throughout the extended period of operation is, therefore, assured.

The staff's review of the BSEP procedure for its Operating Experience Program found that it directs the review of operating experience and requires operating experience to be screened and evaluated for site applicability. Operating experience sources subject to review under this procedure include Institute of Nuclear Power Operations (INPO) and World Association of Nuclear Operators (WANO) operating experience items, NRC documents (INs, GLs, Notices of Violation, and staff reports), 10 CFR Part 21 reports, and vendor bulletins, as well as corporate internal operating experience information from Progress Energy nuclear sites. Plant-specific operating experience has been captured by a review of the PassPort action tracking database and the MR database. This includes a review of work management and leak log records, applicable correspondence, and nuclear assessment records.

The applicant stated that the operating history and assessment results for the Fire Protection Program show that the Fire Protection Program is an effective means of ensuring the preservation from fire of the safe shutdown capability of BSEP. In addition, the applicant stated that the Fire Protection Program is continually upgraded and improved as prompted by industry experience, research, and routine program performance.

BSEP operating history was specifically reviewed with respect to the industry issues presented in GALL AMP XI.M26. The results of this review are as follows: (1) IN 88-56 addresses concerns about voids, gaps, splits, etc. in silicone penetration seals. The operating history indicates no significant problems of this type; (2) IN 94-28 and IN 97-70 addresses concerns about inadequate surveillance of penetration seals. As exemplified by the lack of significant historical findings regarding this issue, surveillance requirements for the penetration seals adequately address this issue; and, (3) IN 91-47 and GL 92-08 address the inadequacy of Thermo-Lag 330-1 fire barriers for use in fire protection applications. This issue was resolved for BSEP in 2002.

On the basis of its review of the above industry and plant-specific operating experience and on discussions with the applicant's technical staff, the staff concluded that the applicant's Fire Protection Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.10, the applicant provided the UFSAR supplement for the Fire Protection Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.8 Fire Water Systems Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.11, "Fire Water Systems Program." In the LRA, the applicant stated that this is an existing program that is consistent, with enhancements, with GALL AMP XI.M27, "Fire Water System."

In the LRA, the applicant stated that this program includes system pressure monitoring, inspections, and periodic testing in accordance with applicable NFPA commitments. Periodic visual inspection of overall system condition and inspections of the internal surfaces of system piping, upon each entry to the system for routine or corrective maintenance, provide an effective means to determine whether corrosion and biofouling are occurring. These inspections include the sprinkler heads and assure that corrosion products that could block flow of the sprinkler heads are not accumulating. These measures will allow timely corrective action in the event of system degradation to ensure the capability of the water-based fire suppression system to perform its intended function.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP's consistency with GALL AMP XI.M27.

The applicant stated that periodic flow testing is performed in accordance with procedures as documented in the staff's Audit and Review Report. However, the system configuration does not support full flow testing through all affected piping and components. As an alternative, the plant maintenance process includes visual inspection of the internal surfaces of the fire protection piping upon each entry into the system for routine or corrective maintenance. The applicant further stated that these inspections include provisions for determining wall thickness to ensure against catastrophic failure and the inner diameter of the piping as it applies to the flow requirements of the fire protection system. In addition, the applicant stated that maintenance personnel are instructed to recognize degraded material conditions and equipment deficiencies, and initiate corrective action in accordance with maintenance and Corrective Action Program procedures.

In the LRA, the applicant stated the following enhancements to make this program consistent with the program in the GALL Report.

Enhancement 1 - Parameters Monitored/Inspected and Monitoring and Trending. The GALL Report identifies the following recommendation for the "parameters monitored/inspected" and "monitor and trending" program elements associated with this enhancement:

> Loss of material due to corrosion and biofouling could reduce wall thickness of the fire protection piping system and result in system failure. Therefore the parameters monitored are the system's ability to maintain pressure and internal system corrosion conditions. Perform periodic flow testing of the fire water system using the guidelines of NFPA 25, Chapter 13, Annexes A & D at the maximum design flow or perform wall thickness evaluations to ensure that the system maintains its intended function.
>
> Results of system performance testing are monitored and trended as specified by NFPA codes and standards. Degradation identified by internal inspection is evaluated.

Enhancement: The Fire Protection Program administrative control documents will be updated to incorporate a requirement to periodically tabulate and assess results from the initial 40-year service life tests and inspections. This information will be used to determine whether a representative sample of such results has been collected and, consequently, whether expansion of scope and subsequent test/inspection means and intervals, incorporating provisions for non-intrusive testing or other corrective action is warranted.

The staff reviewed the BSEP Fire Protection Program Manual, which identifies and describes the organizational responsibilities and authorities, core areas, key processes, process elements, supporting procedures, and interfaces which collectively form the Fire Protection Program. The manual requires that evaluations and reviews, operating requirements/limitations, surveillance requirements, and compensatory measures for fire protection features are incorporated into the Fire Protection Program Manual or supporting fire protection procedures, and plant program procedures.

On the basis of its review of the applicant's Fire Water System Program, the staff determined that this enhancement is acceptable, and that the effects of aging will be adequately managed.

Enhancement 2 - Detection of Aging Effects. The GALL Report provides the following guidance for the "detection of aging effects" program element associated with the enhancement.

> Sprinkler systems are inspected once every refueling outage to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

Enhancement: The majority of the sprinkler heads have been replaced within the last ten years. The remainder (located in the diesel generator building and RHR rooms) will be replaced prior to 50 years of service. This will assure all the sprinkler heads will have less than 50 years service throughout the extended period of operation thereby obviating the need for any extended service inspections (see Commitment Item #7).

By letter dated December 3, 2002, the NRC staff issued ISG-04, "Aging Management of Fire Protection Systems for License Renewal." With regard to replacement and inspection of sprinkler heads, ISG-04 states, "where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing."

In the LRA, the applicant stated that a majority of the sprinkler heads have been replaced within the last ten years. The applicant plans to install the remainder of the new sprinkler heads in Unit 1 prior to 2024 and in Unit 2 prior to 2022. This will ensure that all the sprinkler heads will have less than 50 years service throughout the extended period of operation, thereby obviating the need for any extended service inspections.

On the basis of its review, the staff determined that the above enhancement is acceptable since it is consistent with the guidance provided in ISG-04. Additionally, on the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in BSEP AMP B.2.11 for which the applicant claims consistency with the Fire Water Systems Program in the GALL Report are consistent with the GALL Report.

Operating Experience. In the LRA, the applicant stated that the Fire Water System Program is maintained in accordance with BSEP engineering programs requirements. This provides assurance that the program is effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews; qualified personnel are assigned as program managers, and are given authority and responsibility to implement the program; and adequate resources are committed to program activities.

The applicant also stated that the operating history and assessment results for the Fire Water System Program show it is an effective means of ensuring the preservation from fire of the safe shutdown capability. Since these measures assure continual improvement of the program as prompted by industry experience and research and routine program performance, the capability of the program to support the safe operation of BSEP throughout the extended period of operation is, therefore, assured.

The staff reviewed BSEP procedure for its Operating Experience Program, which directs the review of operating experience and requires that operating experience be screened and evaluated for site applicability. Operating experience sources subject to review under this procedure include INPO and WANO operating experience items, NRC documents (INs, GLs, Notices of Violation, and staff reports), 10 CFR 21 reports, and vendor bulletins, as well as corporate internal operating experience information from all Progress Energy nuclear sites. Plant-specific operating experience has been captured by a review of the PassPort action tracking database and the maintenance rule (MR) database. This included a review of work management and leak log records, applicable correspondence, and nuclear assessment records. The action tracking, MR, and operating experience databases have characteristics that make them relevant to aging concerns, and their information is suitable for keyword searches for license renewal applicability.

The applicant stated that the operating history and assessment results for the Fire Water System Program show it is an effective means of ensuring the preservation from fire of the safe shutdown capability. Since these measures support continual improvement of the program, as prompted by

industry experience and research, and routine program performance, the program has the capability to support the safe operation of BSEP throughout the extended period of operation.

On the basis of its review of the above industry and plant-specific operating experience and on discussions with the applicant's technical staff, the staff concludes that the applicant's BSEP AMP B.2.11 will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.11, the applicant provided the UFSAR supplement for the Fire Water System Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Fire Water System Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff has reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.13, "Fuel Oil Chemistry Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exceptions and enhancements, with GALL AMP XI.M30, "Fuel Oil Chemistry."

In the LRA, the applicant stated that the fuel oil (FO) quality for this program is maintained by monitoring and controlling FO contamination in accordance with the guidelines of American Society for Testing Materials (ASTM) Standards D1796-77 (as specified in ASTM D975-88), D2276-89, and D4057-88. These standards are in accordance with the bases for BSEP Technical Specification Surveillance Requirement 3.8.3.2 for FO testing. Exposure to FO contaminants, such as water and microbiological organisms is minimized by verifying the quality of new oil before its introduction into the storage tanks and by periodic sampling to assure that the tanks are free of water and particulates. The effectiveness of the program is verified using thickness measurement of tank bottom surfaces to ensure that significant degradation is not occurring and to verify the component intended function will be maintained during the extended period of operation.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exceptions and enhancements and the associated justifications to determine whether the AMP, with the exceptions and enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provides an assessment of the AMP's consistency with GALL AMP XI.M30.

The scope of the Fuel Oil Chemistry Program, as stated in the GALL Report, focuses on managing conditions that cause aging degradation of diesel fuel tank inner surfaces. The program is also designed to reduce the potential of exposure on the tank inner surfaces to FO contaminated with water and microbiological organisms.

The applicant stated that the Fuel Oil Chemistry Program is focused on managing conditions, which can cause aging degradation of the internal surfaces of the in-scope components. The applicant stated that BSEP Technical Specifications 5.5.9, "Diesel Fuel Oil Testing Program," requires testing of new and stored FO and includes sampling requirements and acceptance criteria. The staff reviewed this technical specification and determined that it requires sampling and identifies implementing procedures as documented in the staff's Audit and Review Report. The staff reviewed the procedures and determined that these documents appropriately implement the periodic testing and acceptance requirements for FO at BSEP.

The GALL Report discusses the potential benefit of tank coatings in preventing age degradation and recommends FO quality monitoring for water and microbiological organisms, which can lead to loss of material on tank internal surfaces. The applicant stated that BSEP does not employ coatings for corrosion control. The applicant stated that a procedure specifies the frequency of FO quality and water accumulation monitoring for the in-scope tanks. Microbiological growth is evaluated as needed based upon particulate testing results. The staff reviewed the procedure and determined that it implements a program which specifically identifies FO analysis sampling requirements and limits for new and stored FO and the frequency of testing. The staff determined that the applicant's program adequately monitors FO quality in accordance with the GALL Report.

The GALL Report identifies specific ASTM standards for use such as ASTM Standard D4057 for guidance on oil sampling, ASTM Standards D1796 and D2709 for determination of water and sediment contamination, and ASTM D2276 Method A for determination of particulates. The applicant stated that ASTM Standard D4057 is used for guidance on oil sampling. The applicant also stated that BSEP is in conformance with the GALL Report specified ASTM Standard 1796, but has noted specific exceptions to ASTM Standards D2709 and D2276, which are evaluated below. The applicant stated that multi-level, periodic sampling for the main and 4-day tanks is required. The applicant stated that the saddle tanks are much smaller in volume and subject to less variations in FO properties. Sampling is performed 0.5 inches from the tank bottom with re-sampling, if required, at the 1-inch level. Sampling for the diesel-driven fire pump is performed from the drain line that samples the tank bottom. The staff reviewed the sampling requirements and determined that they meet the recommendations of the GALL Report.

The GALL Report specifies an ultrasonic thickness measurement of tank bottom surfaces to ensure significant degradation is not occurring. The applicant responded that tank internal inspection is limited to the main FO storage tank. The applicant indicates that a particular NDE method for use on this tank has not yet been identified. The applicant further stated that the extent of cleaning and/or surface preparation of the tank bottom will be appropriate for the chosen NDE technique. The applicant responded that BSEP will implement a preventive maintenance activity to inspect the main FO storage tank on a ten-year frequency, which will include a one-time inspection and thickness measurement of the tank bottom, as stated in the

UFSAR supplement. On the basis of this review, the staff determined the applicant's inspection plan for the main FO storage tank meets the recommendations of the GALL Report.

In the LRA, the applicant stated the following exceptions to the program elements listed in the GALL Report.

Exception 1 - Scope of Program. The GALL Report identifies the following recommendation for the "scope of program" program element associated with the exception taken:

> The program is focused on managing the conditions that cause general, pitting, and microbiologically influenced corrosion (MIC) of the diesel fuel tank internal surfaces.

Exception: In addition to the storage tanks, the Fuel Oil Chemistry Program is used to manage aging effects on all in-scope components "wetted" by FO. This results in additional materials being within the scope of license renewal beyond those in the GALL Report.

In the LRA, the applicant stated that GALL Report, Section XI.M30, states that the "program is focused on managing the conditions that cause general, pitting, and microbiologically influenced corrosion (MIC) of the diesel fuel tank internal surfaces. The program serves to reduce the potential of exposure of the tank internal surface to FO contaminated with water and microbiological organisms." This reasoning can also be extended to managing the aging of metallic components in a FO environment. The Fuel Oil Chemistry Program also specifies that new fuel be tested in accordance with ASTM D130-94 to assure FO corrosion of copper-alloy components in the diesel system is minimal. These tests and controls ensure that FO system components are exposed to contaminate-free FO with minimal potential to corrode the interior surfaces of carbon steel, copper-alloy and stainless steel components.

During the review and audit, the staff determined that increasing the scope of this AMP to include all components wetted by FO is acceptable and is not considered an exception to the GALL Report. The applicant includes and meets (with noted exceptions and enhancements) the aging management inspections and evaluations for the diesel FO storage tanks, as recommended in the GALL Report. Also, the applicant stated that the condition of the FO storage tanks is considered to be a leading indicator that bounds other materials within the scope of license renewal wetted by FO. In the event that aging degradation is detected in the in-scope FO tanks, appropriate inspections and evaluations of other FO system components will be directed by the Corrective Action Program.

The staff reviewed the procedure for the sampling of FO, as defined in UFSAR, Chapter 1, Table 1-6. The staff agreed that performance of the periodic sampling should detect aging degradation, as discussed by the applicant. Discussions with the applicant's technical staff indicated that the FO lines are primarily carbon steel with some brass fittings. Copper-alloy piping is used for the fire pump, as are some pressure transmitters. The applicant's testing of new fuel in accordance with ASTM D130-94, "Standard Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test," will allow for copper-containing pipes to be monitored for aging. The staff reviewed this standard and determined that it is applicable to the grade of FO used at BSEP and does include inspections for copper-containing pipes to assess degradation.

The applicant stated that the portions of the FO piping that are buried will be managed by the Fuel Oil Chemistry Program and the Buried Piping and Tanks Inspection Program, which will provide for inspection at least once every ten years. On this basis, the staff determined that the above exception is acceptable.

Exception 2 - Preventive Actions and Corrective Actions. The GALL Report identifies the following recommendation for the "preventive actions" and the "corrective actions" program elements associated with the exception taken:

> The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion.

Exception: The Fuel Oil Chemistry Program does not currently use biocides, stabilizers, and corrosion inhibitors.

In the LRA, the applicant stated, per the GALL Report, Section XI.M30, that the quality of FO is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Fuel is purchased to ASTM D975-88 requirements that address stability and corrosion. Biocides, stabilizers, and corrosion-inhibiting additives have not been used at BSEP. Based on operating history and FO management activities, the addition of biocides, biological stabilizers, and corrosion inhibitors into stored fuel is not necessary; however, the option is retained on an as-needed basis.

Additionally, the applicant stated that a combination of tank design and FO management satisfactorily controls water, particulate, and sediment levels. In support of its position, the applicant stated that, in the evaluation of IN 91-46, the storage tanks are maintained full to minimize internal condensation, and that metal deactivators and corrosion inhibitors are added at the FO refinery by the supplier; no additional additives are used.

The Fuel Oil Chemistry Program is implemented by procedures, as documented in the staff's Audit and Review Report, and were reviewed by the staff, and determined that it implements the sampling procedure for the FO. Inspection frequencies and limits for the FO analysis are specified. Measurements are made for particulate, accumulated water, and biological growth, as needed. In discussions with the applicant's technical staff, the applicant stated that there has been no history of water contamination in the periodic samples taken. The staff reviewed a summary of four years (2000-2004) of particulate testing for the 4-day and main FO storage tanks, which are provided as Attachment 2 to BNP-LR-631, and the data confirm that particulate contamination is below specified levels. Only one sample (in 2001) indicated a high level of particulate, which was subsequently corrected.

The applicant's technical staff stated that BSEP uses Grade No. 2-D fuel oil. The staff reviewed ASTM D975-88 and determined that it is applicable to Grade No. 2-D fuel oil. The staff noted that this specification discusses long-term storage (longer than 12 months after receipt by the user). Section X3.7.1 of ASTM D975-88 states, in part, that "Contamination levels in fuel can be reduced by storage in tanks kept free of water, and tankage should have provisions for water draining. . . . Water promotes corrosion, and microbiological growth may occur at a fuel-water interface." The staff reviewed the applicant's management of FO, including the periodic sampling of stored FO, and determined that the applicant's program is adequate to maintain FO quality.

BSEP operating history reviewed by the staff did not show any evidence that water contamination has occurred to any significant degree.

On the basis of the above information, the staff determined that the exception is acceptable.

Exception 3 - Preventive Actions. The GALL Report identifies the following recommendation for the "preventive actions" program element associated with the exception taken:

> Periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time.

Exception: Sample trends at BSEP do not warrant periodic cleaning of in-scope tanks. There currently is no program requirement for periodic cleaning of in-scope tanks, because the sampling trends have not indicated that accumulation of water, sediment, or particulates have been a problem.

In the LRA, the applicant stated, sample trends do not warrant periodic cleaning of in-scope tanks. The GALL Report, Section XI.M30, notes that periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the among of water and the length of contact time. The main FO storage tank is a free-standing, outdoor, carbon steel tank with a low point sump design feature to accumulate potential water and sediment. FO chemistry sampling is performed at various levels within the tank, including the sump. The tap for fuel transfer is above the level of the sump insuring that oil transferred to other tanks is free of water and sediment. The DG 4-day FO storage tanks, the DG day tanks (saddle tanks), and the diesel-drive fire pump day tank are all housed in sheltered environments that are not subject to significant water intrusion or condensation. Particulate and water accumulation is checked every 31 days for the main FO storage tank, the DG 4-day FO storage tanks, the diesel generator saddle tanks, and every 92 days for the diesel-driven fire pump tank. In addition, the 4-day and saddle tanks are inspected for water accumulation after every diesel run of greater than one hour. Fuel added to the main FO storage tank is tested for water and sediment during receipt inspection. FO system design, procurement practices, and testing requirements assure that FO is free of water, sediment, and particulates. There currently is no program requirement for periodic cleaning of in-scope tanks because the sampling trends have not indicated accumulation of water.

The staff reviewed documents that implement the periodic sampling of tank contents for water and sediment, as well as the relevant BSEP operating experience, as discussed above. The applicant provided information on the design (presence of sump, size, physical location) of each FO storage tank in the scope of license renewal. The staff viewed photos of the in-scope tanks, as well as sketches on OE&RC-1010 to understand the applicant's bases. The documents reviewed supported the applicant's bases regarding tank design and periodic sampling.

In the LRA, the applicant stated that, based on the FO system design, procurement practices, and testing requirements, the FO is free of water, sediment, and particulates. The staff reviewed a four year sampling of data on sediments in the FO tanks, which confirm the applicant's conclusion that there are no sediments in the tanks. On the basis of this review, the staff determined that the exception from periodic cleaning is acceptable.

The GALL Report also indicates benefits associated with periodic draining. The staff noted that LRA Section B.2.13 includes an exception to periodic cleaning of the FO tanks, but does not specifically address periodic draining. This was not identified as an exception by the applicant in LRA Section B.2.13. In response, the applicant stated that an exception was not claimed because the GALL Report discusses the benefits of FO tank draining in two different contexts, one for the removal of water and the other as an adjunct to cleaning. The applicant stated that corrective actions are taken when water is drained from the tanks during periodic surveillance. Sampling procedures include requirements for water removal (draining) should water be detected. With respect to draining as an adjunct to cleaning, the applicant stated that current plant operating experience has not shown a need to clean the 4-day, saddle, or diesel fire pump tanks. Therefore, draining is not applicable. The applicant decides on cleaning and/or draining the main FO storage tank based on the inspection results obtained.

The staff noted that the applicant periodically samples the in-scope tanks for sediment, contaminants, and water; and takes corrective action upon discovery. The applicant plans to inspect the main FO storage tank, and, if required, drain and clean it prior to the period of extended operation. The relatively small holding volume of the 4-day, saddle, and diesel fire pump tanks tends to result in the FO stored in these tanks being used and refilled periodically during component testing, thus minimizing the potential for water accumulation. On the basis of this review, the staff concluded that the exception from periodic draining is acceptable.

Exception 4 - Parameters Monitored/Inspected and Acceptance Criteria. The GALL Report identifies the following recommendation for the "parameters monitored/inspected" and acceptance recommendation program element associated with the exceptions taken:

> The ASTM Standards D1796 and D 2709 are used for determination of water and sediment contamination in diesel fuel. For determination of particulates, modified ASTM D 2276, Method A, is used. The modification consists of using a filter with a pore size of 3.0 µm, instead of 0.8 µm.

Exception: (1) ASTM D2709 is not utilized at BSEP and (2) sampling of particulate contaminants, in accordance with ASTM D2276-89, is performed using a filter with a pore size of 0.8 µm versus a pore size of 3.0 µm, as specified in GALL.

In the LRA, the applicant stated the following: (1) NUREG-1801, Section XI.M30, recommends the use of ASTM Standards D1796-97 and D2709-96 as the standard test methods for water and sediment in fuel oils. UFSAR Table 1-6, "Confirmation to NRC Regulatory Guides," summarizes: (1) BSEP commitments to Regulatory Guide 1.137, "Fuel Oil Systems for Standby Diesel Generators," and (2) BSEP commitments to use ASTM D975-88 as the "Standard Specification for Diesel Fuel Oils" and ASTM D4057-88 for oil sampling. BSEP FO testing is based on ASTM D1796-68 (re-approved 1977), "Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)," in lieu of ASTM D2709, for determining water and sediment. ASTM D1796-68 is considered a more appropriate test for the FO used at BSEP, because (1) it is the method prescribed by ASTM D975-88; and, (2) sampling of particulate contaminants, in accordance with ASTM D2276-89, is performed using a filter with a pore size of 0.8 µm versus a pore size of 3.0 µm as specified in NUREG-1801. NUREG-1801, Section XI.M30, recommends that a modified ASTM D2276-00, Method A, be used for determination of particulates. The modification consists of using a filter with a pore size of 3.0 µm, instead of 0.8 µm. ASTM D2276 covers the test method for determination of particulate

contaminants in aviation turbine fuel using a field monitor. At BSEP, FO is currently sampled for suspended particulate using ASTM D2276-89 as a laboratory test. Therefore, the BSEP testing provides results equivalent or superior to those obtained using a 3.0 µm pore size as recommended in the GALL Report.

UFSAR Table 1-6 summarizes the applicant's commitments to Regulatory Guide 1.137. These commitments include the use of ASTM D4057-88 as the "Standard Specification For Diesel Fuel Oils," and the use of ASTM D4057-88 for oil sampling. ASTM D975 references the use of ASTM D1796 for determining water and sediment. The staff reviewed this standard and concurs that it is applicable to the grade of FO utilized, and that it does not reference ASTM D2709. The fact that the operating history at BSEP has shown that water, sediment, and particulates are not a problem at BSEP confirms the adequacy of the current method being used.

Based on this, as well as the use of ASTM D975 to meet RG 1.137, the staff determined that the exception to using ASTM D2709 is acceptable.

The staff reviewed the applicant's exception to the filter pore size requirements of ASTM D2276-89. The staff reviewed ASTM D2276 and determined that it provides guidance on the sampling of particulate contamination in aviation fuel. The applicant stated that the exception to using a smaller filter pore size than prescribed in ASTM D2276 will provide equivalent or superior results. The staff agreed with this reasoning and noted that this exception has been accepted at other facilities. The fact that the operating history has shown that particulates are not a problem at BSEP confirms the adequacy of the current method.

Based on the results of the above review, the staff concluded that these exceptions are acceptable.

Exception 5 - Detection of Aging Effects. The GALL Report identifies the following recommendation for the "detection of aging effects" program element associated with the exception taken:

> Internal surfaces of tanks that are drained for cleaning are visually inspected to detect potential degradation. However, corrosion may occur at locations in which contaminants may accumulate, such as a tank bottom, and an ultrasonic thickness measurement of the tank bottom surface ensures that significant degradation is not occurring.

Exception: Tank internal inspection is limited to the main fuel oil storage tank.

In the LRA, the applicant stated the following: tank internal inspection is limited to the main FO storage tank. The GALL Report, Section XI.M30, states:

> Internal surfaces of tanks that are drained for cleaning are visually inspected to detect potential degradation. However, corrosion may occur at locations in which contaminants may accumulate, such as a tank bottom, and an ultrasonic thickness measurement of the tank bottom surface ensures that significant degradation is not occurring.

At BSEP, internal inspection of the 4-day, saddle, and diesel fire pump tanks will not be performed. Access to these small, elevated tanks is limited, making cleaning and internal inspections impractical. The tanks are sampled for water and particulates from the low point at

least quarterly. External ultrasonic inspection of the bottom of these tanks will be performed. BSEP operating experience indicates that degradation of these tanks is not occurring. The Fuel Oil Chemistry Program ensures that high quality, non-corrosive, non-biologically-contaminated FO is maintained. Fuel analysis results are monitored and trended to detect degradation of tank internals. Corrective action is initiated as necessary to maintain tank integrity.

The description of GALL AMP XI.M30 recommends that a visual inspection be performed on the internal surfaces of the tanks upon draining to detect potential degradation. The applicant stated that internal inspections of the 4-day, saddle, and diesel fire pump tanks will not be performed, as access to these small, elevated tanks is limited, making cleaning and internal inspection impractical. The staff examined photos of these tanks and agreed that cleaning and a visual inspection would be difficult to perform and obtain meaningful results. In discussions with the staff, the applicant stated that the contents of the tanks are sampled for water and particulates from the low point at least quarterly. The applicant stated that American Petroleum Institute STD-653 allows the substitution of external tank inspections for internal inspections where bottom thickness can be determined by other means. As an alternate, the applicant will perform an external NDE inspection, consisting of a UT thickness measurement, on the bottom of these tanks. The applicant stated that NDE examinations were completed on the emergency fire pump storage tank and several 4-day storage tanks, and no problems relating to tank wall thickness degradation were found.

In response to a staff question during the audit, the applicant described three locations where test results indicated a potential wall thickness less than the typical readings obtained from other locations. The staff reviewed nonconformance report (NCR) 69220 dated 04/23/03, which noted apparent discrepancies with the NDE thickness results on this tank. Three locations indicated a potential wall thickness less than the typical readings taken at various other locations on the tank. Each location indicated a point approximately 0.25 in round and approximately 50 percent of the wall thickness. The typical wall thickness is 0.47 inches with the subject three points reading approximately 0.20 inches. The indications noted were isolated, indicating they were contained, embedded inclusions caused by the plate rolled-steel fabrication process. The report noted that inspection personnel were able to maintain a constant backwall signal during the ultrasonic examination process verifying the three noted indications were not a tank wall degradation issue. The staff concluded that the location and size of these anomalies are adequately documented, indicating that monitoring in accordance with this program will detect any changes during subsequent NDE of the tank bottom.

The staff also agreed that the satisfactory performance of these inspections demonstrates that the external NDE will detect aging degradation of these tanks. The staff also noted that the operating history at BSEP has shown that water, sediment, and particulates have not been a problem, which indicates that aging degradation of the tanks would not be severe and that the inspection technique proposed by the applicant will be adequate.

On the basis of this review, the staff concluded that the exception from internal tank inspections for the 4-day tanks, the emergency diesel fire pump FO tank, and the saddle tanks is acceptable. The acceptability of the applicant's internal inspection of the main FO storage tank was presented previously.

In the LRA, the applicant stated the following enhancements to this program to make it consistent with the GALL Report.

Enhancement 1 - Detection Of Aging Effects. The GALL Report identifies the following criterion for the "detection of aging effects" program element associated with the enhancement:

> Internal surfaces of tanks that are drained for cleaning are visually inspected to detect potential degradation. However, corrosion may occur at locations in which contaminants may accumulate, such as a tank bottom, and an ultrasonic thickness measurement of the tank bottom ensures that significant degradation is not occurring.

Enhancement: Thickness measurements of in-scope tanks and an internal inspection of the Main Fuel Oil Storage Tank will be performed under the One-Time Inspection Program (see Commitment Item #9).

The staff noted that the applicant's exceptions, which are discussed above, are related to this enhancement. The staff concluded that the performance of an internal inspection on the main FO storage tank, and the NDE thickness measurements of in-scope tanks under the One-Time Inspection Program are acceptable. The staff reviewed the program description for the One-Time Inspection Program and determined that it includes the in-scope FO storage tanks. Therefore, the staff concluded that this enhancement is acceptable since it performs the inspections identified and found acceptable for this program.

Enhancement 2 - Monitoring and Trending. The GALL Report identifies the following recommendation for the "monitoring and trending" program element associated with this enhancement:

> Water and biological activity or particulate contamination concentrations are monitored and trended at least quarterly.

Enhancement: Program element "administrative controls" will be enhanced to add a requirement to trend sampling data for water and particulates (see Commitment Item #9).

The applicant stated that water and particulates are monitored at least quarterly, and biological growth evaluations are run on samples from tanks at the discretion of the Environmental and Radiation Control (E&RC) supervisors, if the particulate contamination levels appear to be increasing. The staff confirmed the implementation, by procedure, of the quarterly testing. The procedure also specifies that out-of-specification results will be reported to operations and the system engineer for evaluation and initiation of timely corrective actions, and copies of completed analysis should be sent to the system engineer. The applicant stated that the procedure will be modified to trend the data for water and particulates. The staff reviewed the associated Action Plan which details the implementation action as described in the Audit and Review Report for this enhancement.

The applicant described upgrades that will be implemented to the Fuel Oil Chemistry Program prior to the period of extended operation. BSEP is in the process of upgrading to more contemporary testing standards as follows: ASTM Standards D975-00, D130-94, D1796-97, and D4057-88 will apply. In addition, ASTM D6217-98 will replace ASTM D2276-89 due to issues associated with filter quality control. The new standard prevents filter clogging to the point that a particulate calculation cannot be performed. The GALL Report does not specify specific revisions to ASTM standards; therefore, the staff determined that the applicant's upgrade is acceptable. The change to an alternate standard for particulate testing will not negatively impact the quality of

the result, but rather will ensure the performance of particulate calculations. The staff determined that this revision is acceptable.

Based on the above review, the staff concluded that this enhancement is acceptable.

On the basis of its review of the program elements, and on discussions with the applicant's technical staff, the staff concluded that those program elements in Fuel Oil Chemistry Program for which the applicant claims consistency with GALL AMP XI.M30 are consistent with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that:

> Most of the operating experience related to the fuel oil chemistry program involved improvements to the program, procedures, and training by means of self-assessments and other individual initiatives.
>
> BSEP has experienced instances of low fuel flash point in new shipments of oil and one occurrence of discoloration of the fuel oil in a saddle tank. The apparent cause of the fuel oil discoloration was engine lube oil leaking past a degraded oil seal; however, an analysis confirmed that the critical characteristics for the fuel remained within specification. Also, a leak in a buried fuel oil transfer line was experienced and was attributed to a defect in the external coating of the pipe, leading to localized corrosion and eventual loss of pressure boundary integrity.

A review of plant operating data, conducted by the applicant, did not identify any instances of water in the fuel, particulate contamination, or biological fouling. No FO system component failures attributed to FO contamination have been identified.

The applicant stated that a review of the Corrective Action Program was performed to obtain experience with FO chemistry. The documents reviewed by the applicant included a combination of self-assessment reports, NCRs, and NRC inspections. A number of NCRs resulted in self-identified program improvements that the applicant stated represent a heightened focus on attention to details and process improvement.

Many of the NCRs identified only minor procedural violations which had no impact on system operability. Several NCRs identified potential FO quality issues that could have impacted operability (new FO shipments with lower than acceptable flash points, unannounced FO supplier practices, and color variations). In each instance, the applicant identified the potential issue and determined that operability was not affected. One NCR identified a leak in a FO transfer line between the main FO storage tank and the unloading station. Though this portion of the line is not in-scope for license renewal, it did highlight the importance of inspecting buried pipes for this system, which will be performed under the Buried Piping and Tanks Inspection Program.

The applicant also noted an NRC inspection, October 19, 2001, that reviewed test data sheets and the station acceptance criteria for FO quality to verify that these were consistent with the EDG vendor recommendations and applicable industry standards. All BSEP FO program practices were found to be satisfactory.

The staff selected several adverse condition investigation reports and NCR's and reviewed the applicant's conclusions. The applicant concluded that the current practices were adequate, but should be re-evaluated if a different FO supplier is used. No changes were needed to the current FO storage practices for the main FO storage tank, which call for the tank to be filled to heights greater than 20 feet to minimize condensation.

UFSAR Supplement. In LRA Section A.1.1.13, the applicant provided the UFSAR supplement for the Fuel Oil Chemistry Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Fuel Oil Chemistry Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications, and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the staff has reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.14., "Reactor Vessel Surveillance Program," an existing program that is consistent, with enhancement, with GALL AMP XI.M31.

Appendix H of Part 50 to Title 10, *Code of Federal Regulations*, "Reactor Vessel Material Surveillance Program Requirements," provides the staff's requirements for implementing the surveillance programs that are required for a plant's RV beltline materials. The programs are used to monitor for any changes in fracture toughness properties of a plant's RV beltline base metal and weld materials as a result of neutron irradiation during the plant's service lifetime. Appendix H may be accessed at NRC web page:

http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-apph.html

Section III.C of 10 CFR Part 50, Appendix H, provides the specific requirements related to the implementation of an integrated surveillance program (ISP).

The Boiling Water Reactor Vessel and Internals Project (BWRVIP) has developed an ISP for the RV base metal and weld materials in all operating U.S. BWRs. The BWRVIP provided its ISP in Proprietary Topical Reports BWRVIP-78, "BWR Vessel and Internals Project: BWR Integrated Surveillance Program (ISP) Plan," and BWRVIP-86, "BWR Vessel and Internals Project: BWR Integrated Surveillance Program (ISP) Implementation." These proprietary reports are applicable to the design and implementation of the ISP by U.S. BWRs during their first 40-year operating

period and were approved by the NRC in its Final Safety Evaluation Report (FSER) to the BWRVIP dated February 1, 2002.

The BWRVIP issued Proprietary Topical Report BWRVIP-116, "BWRVIP Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," to address the changes in the ISP that would be necessary to support license renewal applications for operating U.S. BWRs. This report is currently in the process of being reviewed by the NRC for generic acceptability to the U.S. fleet of BWRs.

The applicant's description for the RVSP discusses how implementation of the program is accomplished to ensure compliance with the requirements of 10 CFR Part 50, Appendix H and conformance with the BWRVIP's integrated surveillance program provisions and criteria in Topical Report BWRVIP-86, as amended by the pending staff review of Topical Report BWRVIP-116.

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

The applicant identified the RVSP as an existing ISP that is designed to comply with the requirements for ISPs in 10 CFR Part 50, Appendix H and to conform with recommended guidelines in GALL AMP XI.M31, "Reactor Vessel Surveillance." The applicant stated that the RVSP is described in UFSAR Section 5.3.1.6.

The applicant stated that the RVSP is based on the BWRVIP's ISP, as described and discussed in Proprietary Topical Reports BWRVIP-78, "BWR Integrated Surveillance Program (ISP) Plan," and BWRVIP-86, "BWR Vessel And Internals Project, BWR Integrated Surveillance Program Implementation." The ISP provides for a number of surveillance capsules to be removed from specified BWRs and to be available for testing during the license renewal period for the BWR fleet. The ISP establishes acceptable technical criteria for capsule withdrawal and testing.

The NRC-approved BWRVIP-78 and BWRVIP-86 for generic applicability to the U.S. BWR fleet in the staff's FSER to the BWRVIP dated February 1, 2002. The staff approved the application of the BWRVIP's ISP to the RVs at Units 1 and 2 in the NRC's safety evaluation (SE) to the applicant, dated January 14, 2004. In the SE of January 14, 2004, the staff agreed that the BWRVIP ISP, as approved in Proprietary Topical Reports BWRVIP-78 and BWRVIP-86-A (the NRC-approved version BWRVIP-86), met the requirements of 10 CFR Part 50, Appendix H and ASTM Standard Practice E185-82 as they apply to the structural integrity and fracture toughness evaluations for the Units 1 and 2 RVs. The staff also agreed that, as a participant in the BWRVIP's ISP, BSEP would not be required to remove any of the remaining RV surveillance capsules on behalf of the program. Instead, as indicated in Proprietary Topical Report BWRVIP-86-A, the staff concluded that surveillance capsules from other BWRs in the U.S. BWR fleet are acceptable for representing and evaluating the plate and weld materials in the RVs.

Proprietary Topical Reports BWRVIP-78 and BWRVIP-86-A, the staff's generic FSER of February 1, 2002, and the staff's SE of January 14, 2004, provide an acceptable basis for approving the RVSP for the current operating periods for the units. To address the impacts of license renewal on the RVSP, the applicant stated that the AMP will be enhanced to address any

changes that may be necessary to extend the applicability of the AMP through the periods of extended operation for BSEP. The staff discussed and evaluated the applicant's enhancement of the RVSP in the "Enhancements and Commitments for the RVSP" section of this evaluation.

Enhancement: The applicant stated that the BWRVIP's ISP has been enhanced to address the impact of license extension on the ISP for BWR facilities and that the enhanced program is described and discussed in Proprietary Topical Report BWRVIP-116. The applicant stated that the RVSP will incorporate the following enhancement:

> BSEP plans to continue using the Integrated Surveillance Program during the period of extended operation by implementing the [recommendations] of BWRVIP-116, which is under NRC review at this time.

Proprietary Topical Report BWRVIP-116 was submitted by the BWRVIP to the NRC in 2003 to address the impacts of license extension on the ISP's proposed surveillance capsule withdrawal schedule and to determine whether additional ISP capsules would need to be designated for addition to the proposed surveillance capsule withdrawal schedule. Proprietary Topical Report BWRVIP-116 is currently in the process of being reviewed by the staff. The applicant has acknowledged that the NRC's review of Proprietary Topical Report BWRVIP-116 is still pending; therefore, it provided Commitment Item #10 for the RVSP in BSEP serial letter, BSEP-05-0148, dated December 6, 2005:

> The Reactor Vessel Surveillance Program will be enhanced to ensure that any additional requirements that result from the NRC review of Boiling Water Vessel [and] Internals Program (BWRVIP)-116 are addressed prior to the period of extended operation.

The applicant's commitment will ensure that the any changes to the withdrawal schedule requirements for the ISP, as approved in the NRC's acceptance of BWRVIP-116 and found to be applicable to the applicant's RVs, will be incorporated into the RVSP. Since this enhancement of the RVSP has been included as a commitment for the LRA, the staff concluded that the applicant's commitment for the RVSP will ensure that the monitoring of the BSEP-1/2 RVs for neutron irradiation embrittlement will account for the impacts of aging on the embrittlement trends for the vessels and will be implemented in accordance with Topical Report BWRVIP-116 pending staff approval. Based on this evaluation, the staff concludes that RVSP, as enhanced by Commitment Item #10 on the LRA, is acceptable.

Operating Experience. In the "operating experience" program element for the RVSP, the applicant stated that the RVSP is an ISP which is based on Proprietary Topical Reports BWRVIP-78 and BWRVIP-86-A and that generic approval for using these industry initiative reports was granted by the NRC in its FSER to the BWRVIP dated February 1, 2002. The applicant stated that plant-specific approval of the RVSP was granted for BSEP in the NRC's SE dated January 14, 2004. The staff confirmed that these topical reports and NRC evaluations are applicable to the staff's approval of the RVSP.

The RVSP is an integrated surveillance program that has been proposed by the BWRVIP on behalf of BWRs in the U.S. and that has been approved by the staff for implementation by the utilities that own BWRs participating in the BWRVIP's monitoring programs. The current NRC-approved program for BSEP does not require the applicant to remove the BSEP RV surveillance capsules for testing. Thus, there is not any BSEP-specific operating experience that is directly

applicable to the RV structural integrity assessments for BSEP. Instead the plant is relying of generic test results from surveillance tests performed on other capsules that have been removed from other U.S. BWR RVs. The surveillance test results from the generic integrated surveillance program, which was approved in the staff's SE dated January 14, 2004, provides acceptable generic operating experience that is applicable to the RV integrity assessments for the BSEP RVs (Refer to the staff's assessment in SER Section 4.2 on the applicant's TLAAs for managing neutron irradiation embrittlement of the RV and internal components).

UFSAR Supplement. 10 CFR 54.21(d) requires that the UFSAR supplement for a facility LRA must contain a summary description for each AMP and TLAA that is proposed for aging management. The applicant provided the following UFSAR supplement summary description for the RVSP:

> **A.1.1.14 Reactor Vessel Surveillance Program**
>
> The Reactor Vessel Surveillance Program is mandated by 10 CFR 50, Appendix H. The Program is an Integrated Surveillance Program, in accordance with 10 CFR Part 50, Appendix H, Paragraph III.C, that is based on requirements established by the BWR Vessel and Internals Project reports.
>
> This Program will be enhanced to ensure that any additional requirements that result from the NRC review of BWRVIP-116 are addressed prior to the period of extended operation. The enhanced Program will be consistent with the corresponding program described in NUREG-1801.

The applicant's UFSAR supplement summary description for the RVSP is consistent with the description of the AMP that is given in LRA Section B.2.14. The staff found that the UFSAR supplement summary description is acceptable because it accomplishes the following regulatory functions:

(1) The summary description indicates that the RVSP is an ISP that is designed to comply with the requirements for ISPs in Section III.C. of 10 CFR Part 50, Appendix H. This is consistent with the staff's approval of the RVSP for the current operating periods for BSEP, as documented in the staff's SE dated January 14, 2004, and confirms that the staff has approved the RVSP for implementation.

(2) The summary description indicates that the RVSP will be enhanced to address the need to amend the integrated withdrawal schedule for the surveillance capsules representing the BSEP RVs as potentially impacted by the staff's pending review of Proprietary Topical Report BWRVIP-116. This is acceptable because it is consistent with the staff's process for reviewing and approving the BWRVIP's ISP, as impacted by license renewal, and because the applicant has incorporated a commitment in the LRA to ensure that this will be done.

In the most recent staff-approved version of the ISP, the RV surveillance capsules from BSEP have not been designated for removal and testing to support the ISP. However, as addressed in Section III.C.1.d of 10 CFR Part 50, Appendix H, and in the staff-approved BWRVIP ISP, maintaining adequate contingencies to support potential changes to the program is an important part of any ISP. The staff plans to discuss with the BWRVIP the issue of maintenance of standby capsules for future use. Until there is more detailed guidance regarding the treatment of standby capsules, the staff imposed the following license condition to ensure that any surveillance

capsules removed from BSEP, without the intent to test them, are maintained in a condition which would permit their future use, including use during the period of extended operation, if necessary:

> The third license condition requires the implementation of the most recent staff-approved version of the Boiling Water Reactor Vessels and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) as the method to demonstrate compliance with the requirements of 10 CFR Part 50, Appendix H. Any changes to the BWRVIP ISP capsule withdrawal schedule must be submitted for NRC staff review and approval. Any changes to the BWRVIP ISP capsule withdrawal schedule which affects the time of withdrawal of any surveillance capsules must be incorporated into the licensing basis. If any surveillance capsules are removed without the intent to test them, these capsules must be stored in manner which maintains them in a condition which would support re-insertion into the reactor pressure vessel, if necessary.

The imposition of this license condition is consistent with actions that the staff has taken with other, recent license renewal applicants with respect to the control of "standby" RV surveillance capsules.

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

3.0.3.2.11 One-Time Inspection Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.15, "One-Time Inspection Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exceptions and enhancement, with GALL AMP XI.M32, "One-Time Inspection."

In the LRA, the applicant stated that this program uses one-time inspections to verify the effectiveness of an AMP 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 reasonably be extrapolated through the period of extended operation. The One-Time Inspection Program is credited for aging management of the following structures/components: water chemistry verification; fuel oil tanks in scope for license renewal; control rod drive pump casings, orifices, and piping; control rod drive hydraulic control unit filters; RHR throttle valves; internal surfaces of piping in moist environments; internal surfaces of relief valve discharge lines, piping and valves; carbon steel, copper-alloy, and elastomeric components; internal surfaces of carbon steel components (not covered by the Preventive Maintenance Program); intake and exhaust silencers; internal surfaces of components; tanks, piping, valves; uncoated component supports and portions of the torus liner; interior surfaces of SRV discharge piping (tail pipes); and components exposed to raw water.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP

Audit and Review Report. The staff reviewed the exception and enhancement and the associated justifications to determine whether the AMP, with the exception and enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP's consistency with GALL AMP XI.M32.

In the LRA, the applicant stated the purpose of the One-Time Inspection Program is to inspect the current condition of a structure/component to predict its aging-related condition through the license renewal period. In accordance with the GALL Report, the One-Time Inspection Program verifies the effectiveness of an existing AMP; that is, that unacceptable degradation is not occurring; and determines the need for additional aging management for structures/components currently not managed by other AMPs. The program includes a verification of the effectiveness of both the Water Chemistry Program and Fuel Oil Chemistry Program. The program also includes a number of non-GALL inspections based on plant-specific AMRs. The staff compared the scope of the One-Time Inspection Program to that described in the BSEP calculation for the Water Chemistry Program and Fuel Oil Chemistry Program, as discussed in the staff's Audit and Review Report. For both programs, the scope and methods were found to be consistent with the One-Time Inspection Program.

As documented in the staff's Audit and Review Report, the applicant stated that each structure/component inspected under its One-Time Inspection Program is evaluated against a unique set of considerations based on determination of sample size, based on assessment of material, environment, plausible aging effects and operating experience; identification of inspection locations, based on the aging effect; determination of the examination technique, including acceptance criteria that would be effective; evaluation of the need for follow-up examinations to monitor progression of aging degradation; and corrective actions, including expansion of sample size and locations. The applicant further stated that inspection methods will include a variety of NDE methods (visual, volumetric, and surface techniques) performed by qualified personnel and will use applicable codes and standards in accordance with LRA Appendix B quality assurance requirements. The staff determined that the inspection techniques, when evaluated against applicable codes and standards, are consistent with the recommendations in the GALL Report.

The GALL Report recommends a representative sample of the system population to be chosen to focus on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. The applicant stated the inspection sample size will be based on several considerations, including accessibility, leading or bounding locations, safety significance, severity of operating conditions, and design margins. The applicant further stated that, where feasible, it is acceptable to use like material and environment combinations in alternate components/systems for verification of the Water Chemistry Program. Also the one-time inspection for AMP effectiveness will include: determination of the sample size, based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; identification of the inspection locations in the system or component, based on the aging effect; determination of the examination technique, including acceptance criteria that would be effective for managing the particular aging effect; and an evaluation of the need for a follow-up examination to monitor the progress of any aging.

The applicant stated that system boundaries can be arbitrary relative to service environments and materials. Therefore, components in one system can be considered to be representative of components in another system when determining sample population. The applicant stated that this will not be used as a basis to reduce sample size and will include at least one representative component per system.

The applicant stated that, in accordance with the GALL Report, the one-time inspections will be completed before the end of the current operating license. The inspections will be scheduled to minimize the impact on plant operations. The applicant stated that the inspections will be scheduled during the fourth quarter of the current licensing period, and the results will be evaluated in accordance with site procedures. The staff determined that this is consistent with the recommendations in the GALL Report.

The staff noted that the GALL Report recommends either an appropriate AMP to manage the aging effects, plus a one-time inspection to confirm the effectiveness of the AMP, or the use of periodic inspections. The staff asked the applicant to provide the technical bases for concluding that a one-time inspection would provide adequate assurance that aging degradation will not occur during the period of extended operations for those instances in which the one-time inspection alone is credited by the applicant. The applicant stated that the BSEP program is consistent with the GALL Report since they are using the Water Chemistry Program, Fuel Oil Chemistry Program, and One-Time Inspection Program for verification of effectiveness. The applicant further stated that, for cases where a one-time inspection is credited without an accompanying AMP, one of the following applies: (a) an aging effect is not expected to occur, but the data are insufficient to rule it out with reasonable confidence; (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected; or (c) the characteristics of the aging effect include a long incubation period. For these cases, there is to be confirmation that either the aging effect is indeed not occurring or that the aging effect is occurring very slowly so as not to affect the component or structure intended function during the period of extended operation.

The applicant further noted that 30 years of operational experience will have accumulated before inspections are performed and that this time period will be sufficient for the aging effects to manifest themselves. The One-Time Inspection Program will verify the correctness of these expectations or serve as a basis for subsequent corrective actions. The staff determined that this approach is consistent with the recommendations of the GALL Report and is acceptable.

The applicant stated that this program is not intended to be a monitoring or trending program. Any degradation encountered will be evaluated, corrected, and, if required, monitored and trended in accordance with the Corrective Action Program. Any indications or degradation conditions will be evaluated. The staff, in its review of the Diesel Fuel Oil Program, confirmed that one-time thickness inspections of in-scope tanks will be compared against as-built dimensions. The staff determined that the applicant's approach is consistent with the recommendations in the GALL Report, and is acceptable.

In the LRA, the applicant stated the following exception to the program elements in the GALL Report.

Exception 1 - Scope of Program. The GALL Report identifies the following recommendation for the "scope of program" program element associated with the exception taken:

The program includes measures to verify that unacceptable degradation is not occurring, thereby validating the effectiveness of existing AMPs or confirming that there is no need to manage aging-related degradation for the period of extended operation. The structures and components for which one-time inspection is to verify the effectiveness of the AMPs...have been identified in the ...(GALL) Report. Examples include small bore piping in the reactor coolant system or feedwater system components in boiling water reactors (BWRs).

Detection Of Aging Effects. The GALL Report identifies the following for "detection of aging effects" program element associated with the exception taken:

For small-bore piping, actual inspection locations are based on physical accessibility, exposure levels, NDE techniques, and locations identified in Nuclear Regulatory Commission (NRC) Information Notice (IN) 97-46.

Exception: BSEP does not utilize the One-Time Inspection Program activity specified in the GALL Report for detection of cracking in small-bore Class 1 piping. Cracking of this piping will be detected and managed by the combination of the ASME Section XI, Subsection IWB, IWC and IWD Program supplemented by the Water Chemistry Program. This is justified by the evaluations performed during implementation of the RI-ISI Program and by operating experience which shows a lack of indications that cracking of this piping is occurring. In support of the submittal, evaluations of degradation mechanisms were performed and demonstrated that no locations had a high failure potential on small bore pipe due to thermal stratification, cycling, and striping (TASCS) and thermal transients (TT). The RI-ISI evaluations considered lines greater than 1-inch in diameter. For lines 1-inch and smaller, cracking due to thermal loadings was evaluated and dispositioned as not applicable. Cracking due to mechanical loadings was evaluated by a review of plant-specific operating experience; no relevant operating experience was found. The risk associated with cracking due to SCC of these lines is bounded by those components selected for inservice inspection as part of RI-ISI Program. Therefore, the current inspection methods as detailed in the ASME Section XI, Subsection IWB, IWC and IWD Program supplemented by the Water Chemistry Program will manage cracking of small bore piping systems.

The staff notified the applicant that the NRC does not recognize a current RI-ISI evaluation as an acceptable technical basis for excluding inspection of small bore piping for license renewal and requested the applicant to identify a program that is consistent with the GALL Report.

In its initial response during the audit, the applicant stated that the One-Time Inspection Program will be revised to include verification of aging management program effectiveness on pipes and fittings less than four inches within ASME Code Class 1 boundaries. The response also stated that the program will include piping components that (1) are large enough such that their failure might be beyond the capability of normal reactor makeup; and, (2) have been evaluated as being susceptible to the cracking mechanisms noted in the GALL Report Section IV.C1.1.13.

Regarding criterion (1), the applicant stated that, per 10 CFR 50.55a(c)(2), components that are connected to the RCPB and are part of the reactor coolant pressure boundary can be excluded from the requirements set forth in Code Class 1 components, provided that in the event of a postulated failure of the component during normal reactor operation, the reactor can be shut down and cooled in an orderly manner assuming makeup is provided by the reactor coolant makeup system.

Regarding criterion (2), the applicant stated that item IV.C1.1.13 in the GALL Report addresses aging management requirements for BWR RCPB piping and fittings less than four inches and identifies crack initiation and growth/stress corrosion cracking, IGSCC, and thermal and mechanical loading as aging mechanisms of concern. The applicant stated that a similar analysis has been performed for BSEP and concludes that certain lines are not susceptible to thermal and mechanical loading based on design or service considerations. Similarly, BSEP AMRs have concluded that carbon steel piping in this category is not susceptible to SCC. Piping components that are evaluated and determined not susceptible to the cracking mechanisms noted in the GALL Report, item IV.C1.1.13, will be exempt from one-time inspections for this aging mechanism.

The applicant further stated that the One-Time Inspection Program will be revised to include the following descriptions of crack detection. The inspection includes a representative sample of the population, and, where practical, focuses on the bounding components or components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. For small bore piping, actual inspection locations are based on physical accessibility, exposure levels, NDE techniques, and locations identified in IN 97-46. Combinations of NDE (including visual, ultrasonic, and surface techniques) will be performed by qualified personnel consistent with the ASME Code and 10 CFR Part 50, Appendix B. For applicable small bore piping, a plant-specific destructive examination of replaced piping (due to plant modification) or NDE that permits inspection of inside surfaces will be performed. Follow-up of unacceptable inspection findings will result in expansion of sample size and locations. These inspections will be completed before the end of the current operating license period.

The applicant concluded its response by stating that the Water Chemistry Program and ASME Section XI (IWB, IWC, and IWD) Program will be credited for aging management of small bore piping. These components will be subject to physical leakage inspections under ASME Section XI and the One-Time Inspection Program will be used to verify the effectiveness of these programs.

After review and discussion of the applicant's initial response by the staff, the applicant revised its response criterion (1) above to state the following (see Commitment Item #11).

> BSEP will revise the One-Time Inspection Program to include verification of aging management program effectiveness on less than four inch piping and fittings within ASME Code Class 1 boundaries. The BSEP One-Time Inspection Program will be revised to include the following description of how cracking will be detected.
>
> The inspection includes a representative sample of the population, and, where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. For small-bore piping, actual inspection locations are based on physical accessibility, exposure levels, NDE techniques, and locations identified in NRC Information Notice 97-46, as applicable.
>
> Combinations of NDE, including visual, ultrasonic, and surface techniques, are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR 50, Appendix B. For small-bore piping less than NPS 4 inches, including pipe, fittings, and branch connections, a plant-specific destructive examination of replaced piping due to plant modifications or NDE that permits inspection of the inside surfaces of the piping will be performed to ensure that cracking has not occurred.

Follow-up of unacceptable inspection findings includes expansion of the inspection sample size and locations.

With respect to inspection timing, the one-time inspection is to be completed before the end of the current operating license.

BSEP credits the Water Chemistry Program and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program (for leakage inspections) for aging management of cracking in less than 4 inch NPS Class 1 piping components. These components will be subject to physical inspections for leakage under the latter program. Additionally, the One-Time Inspection Program will be used, as described above, to verify the effectiveness of these programs.

Upon inclusion of small bore piping in the One-Time Inspection Program as described above, the program will be consistent with the program description found in the GALL Report, AMP XI.M32.

Details regarding the implementation of the one-time inspections including identification of specific sampling techniques and inspection locations, will be formalized prior to the end of the current license term.

The staff determined that the applicant's revised commitment for small bore piping inspection under the One-Time Inspection Program is acceptable on the basis that the applicant has committed to develop a program that is consistent with the GALL Report.

In the LRA, the applicant stated the following enhancement to this program to make it consistent with the recommendations in the GALL Report:

Enhancement - Scope of Program. The GALL Report identifies the following recommendation for "scope of program" program element associated with the enhancement:

> The program includes measures to verify that unacceptable degradation is not occurring, thereby validating the effectiveness of existing AMPs or confirming that there is no need to manage aging-related degradation for the period of extended operation.

Enhancement: Procedural controls will be developed to track, implement, complete, and report activities associated with one-time Inspections.

The applicant stated that this is an enhancement because it identifies activities that represented a change to existing processes and procedures in order to be consistent with the recommendations of the GALL Report. In the case of this enhancement, the applicant committed to develop procedural controls to implement the inspection activities (see Commitment Item #11). The staff determined that the applicant's proposed enhancement is acceptable on the basis that procedural controls are essential to ensuring that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and discussions with the applicant's technical staff, the staff concluded that those program elements in the One-Time Inspection Program for which the applicant claims consistency with GALL AMP XI.M32 are consistent with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that the One-Time Inspection Program is a new program. The BSEP aging management review process ensures that one-time inspections have been prescribed and developed with consideration of plant and industry operating experience.

The staff determined that this program will be effective in accomplishing the objectives of the One-Time Inspection Program, upon revision, on the basis that it is consistent with GALL AMP XI.M32. The staff reviewed the implementation of the One-Time Inspection Program in other programs (fuel oil chemistry and water chemistry) and determined that the inspections to be performed and the data to be obtained met the guidance of GALL AMP XI.M32.

The staff recognizes that the Corrective Action Program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

UFSAR Supplement. In LRA Section A.1.1.15, the applicant provided the UFSAR supplement for the One-Time Inspection Program, which states that:

(a) The One-Time Inspection Program uses one-time inspections to verify the effectiveness of an aging management program and confirm the absence of an aging effect. The program scope includes water chemistry and fuel oil chemistry verifications specified by the GALL Report, as well as plant specific inspections

(b) Prior to the period of extended operation, the One-Time Inspection Program will be enhanced by the addition of procedural controls for implementation and tracking activities associated with the program.

The staff reviewed the UFSAR Supplement for the One-Time Inspection Program, and noted that a revision is necessary to specifically identify that the scope of the program also includes small-bore Class 1 piping, as specified in the GALL Report. The staff requested that the applicant identify all required revisions to the BSEP LRA in order to be consistent with its new commitment to include small bore Class 1 piping in the scope of the One-Time Inspection Program (see Commitment Item #11). As documented in the Audit and Review Report, the applicant identified the following revision to the LRA as applicable to the UFSAR supplement:

> A.1.1.15 – The description of the One Time Inspection Program will reflect that the One-Time Inspection Program includes inspection of small bore Class 1 piping for cracking.

The staff reviewed this section and determined that, with the additional commitment, the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's One-Time Inspection Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications, and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the staff has reviewed the enhancement and confirmed that the implementation of the enhancement prior to the period of

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

3.0.3.2.12 Selective Leaching of Materials Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.16, "Selective Leaching of Materials Program." In the LRA, the applicant stated that this is a new program that is consistent, with exception, with GALL AMP XI.M33, "Selective Leaching of Materials."

In the LRA, the applicant stated that this program ensures the integrity of components (such as piping, pump casings, valve bodies, and heat exchanger components) made of cast iron, brasses, and aluminum bronze exposed to a raw water, treated water, moisture-laden air or buried environment (see Commitment Item #12). The program will define a one-time examination methodology and acceptance criteria that will be implemented by the work management process using a qualitative determination of selected components that may be susceptible to selective leaching. Confirmation of selective leaching will be performed with a metallurgical evaluation or other testing methods.

The applicant also stated that the examinations will determine whether loss of material due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended function(s) for the period of extended operation. A sample population will be selected for the inspections which will be completed prior to commencing the period of extended operation (see Commitment Item #12). Evidence suggesting the presence of selective leaching will result in expanded sampling, as appropriate, and engineering evaluation.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exception and the associated justifications to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP's consistency with GALL AMP XI.M33.

In the LRA, the applicant stated the following exception to program elements in the GALL Report:

The GALL Report identifies the following recommendation for "scope of program," "preventive actions," "parameters monitored/inspected," "detection of aging effects," and "monitoring and trending" program elements associated with the exception taken:

> Scope of Program. This AMP determines the acceptability of the components that may be susceptible to selective leaching and assess their ability to perform the intended function

during the period of extended operation. These components include piping, valve bodies and bonnets, pump casings, and heat exchanger components. The materials of construction for these components may include cast iron, bronze, or aluminum-bronze. These components may be exposed to raw water, treated water, or groundwater environment. The AMP includes a one-time hardness measurement of a selected set of components to determine whether loss of material due to selective leaching is not occurring for the period of extended operation.

Preventive Actions. The one-time visual inspection and hardness measurement is an inspection/verification program; thus, there is no preventive action.

Parameters Monitored/Inspected. The visual inspection and hardness measurement is to be a one-time inspection. Because selective leaching is a slow acting corrosion process, this measurement is performed just before the beginning of the license renewal period unacceptable inspection findings included expansion of the inspection sample size and location.

Detection of Aging Effects. The one-time visual inspection and hardness measurement includes close examination of a select set of components to determine whether selective leaching has occurred and whether the resulting loss of strength and/or material will affect the intended functions of these components during the period of extended operation. One acceptable procedure is to visually inspect the susceptible components closely and conduct Brinell Hardness testing on the inside surfaces of the selected set of components to determine if service leaching has occurred. If it is occurring an engineering evaluation is initiated to determine acceptability of the affected components for further service.

Monitoring and Trending. There is no monitoring and trending for the one-time visual inspection and hardness measurement.

Exception: 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 involves the use of examinations, other than Brinell hardness testing, identified in GALL AMP XI.M33. The exception is justified, because (1) 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).

The staff reviewed the applicant's exception and determined that it is justified on the following basis: (1) hardness testing is not feasible for most components due to form and configuration; (2) other mechanical means (i.e., resonance when struck by another object, scraping, or chipping) will be used and provide an equally valid method of identification; and, (3) the applicant's program will include one-time inspections and qualitative determinations of selected components that may be susceptible to selective leaching. The staff considered the applicant's justification to be reasonable and acceptable.

On the basis of its review of the program elements, and discussions with the applicant's technical staff, the staff concluded that those program elements in the Selective Leaching of Materials Program for which the applicant claims consistency with GALL AMP XI.M33 are consistent with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that there is operating experience to indicate that selective leaching of materials has occurred. Evidence of selective leaching has resulted in engineering evaluation and/or component replacement. As this is a new program, there is no operating experience to confirm program effectiveness.

During the audit the staff asked the applicant how operating experience is captured. The applicant indicated that the plant procedure for operating experience increases personnel's awareness of plant and industrial operating experience so that lessons learned can be used to adjust its AMP, as necessary. In its procedure, the applicant stated that it provides guidance for using, sharing, and evaluating operating experience at NGG sites, as well as promoting the identification and transfer of lessons learned by industry. The staff reviewed the applicant's procedure and determined that it is acceptable.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the staff concluded that the Selective Leaching of Materials Program will adequately manage the aging effects for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.16, the applicant provided the UFSAR supplement for the Selective Leaching of Materials Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.13 Buried Piping and Tanks Inspection Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.17, "Buried Piping and Tanks Inspection Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exceptions, with GALL AMP XI.M34, "Buried Piping and Tanks Inspection."

In the LRA, the applicant stated that this program will manage aging effects on the external surfaces of carbon steel, stainless steel, and cast iron piping components that are buried in soil or sand. The aging effects/mechanisms of concern are loss of material due to general, pitting, and crevice corrosion and MIC. To manage the aging effects, this program includes (1) preventive measures (e.g., coatings and wrappings required by design) to mitigate degradation; and, (2) visual inspections of external surfaces of buried piping components, when excavated, for evidence of coating damage and degradation. The periodicity of these inspections will be based on plant operating experience and opportunities for inspection such as scheduled maintenance work requiring excavation. Any evidence of damage to the coating or wrapping, such as

perforations, holidays, or other damage, will cause the protected components to be inspected for evidence of loss of material. The results of visual inspections will be reviewed and evaluated to identify susceptible locations that may warrant further inspections. This program assures that the effects of aging on buried piping components are being effectively managed for the period of extended operation.

The applicant also stated that this program will be implemented prior to the period of extended operation and will include procedural requirements to (1) ensure that an appropriate as-found pipe coating and material condition inspection is performed whenever buried piping within the scope of this program is exposed; (2) add precautions concerning excavation and use of backfill to the excavation procedure to include precautions for license renewal piping; (3) add a requirement that coating inspection shall be performed by qualified personnel to assess its condition; and, (4) add a requirement that a coating engineer or other qualified individual should assist in evaluation of any coating degradation noted during the inspection (see Commitment Item #13).

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP elements' consistency with GALL AMP XI.M34.

In the LRA, the applicant stated the following exceptions to program elements in the GALL Report.

Exception 1 - Scope of Program. The GALL Report identifies the following guidance for the "scope of program" program element associated with the exception taken:

> The program relies on preventive measures such as coating and wrapping and periodic inspection for loss of material caused by corrosion of the external surface of buried carbon steel piping and tanks. Loss of material in these components, which may be exposed to aggressive soil environment, is caused by general, pitting, and crevice corrosion, and microbiologically influenced corrosion (MIC). Periodic inspections are performed when the components are excavated for maintenance or for any other reason.

Exception: In addition to carbon steel piping components, buried stainless steel and cast iron piping components are considered an acceptable exception to the limited material scope delineated by the GALL Report program. The aging effects are managed by use of external coatings and inspections regardless of the piping material. This program includes no buried tanks.

The applicant expanded the scope of its Buried Piping and Tanks Inspection Program to include stainless steel and cast iron piping components. The staff determined that this expansion of the scope does not reduce the effectiveness of the program for managing the aging of carbon steel

piping and tanks. On the basis of its review of documents, and discussions with the applicant's technical staff, the staff concluded that the exception is acceptable.

Exception 2 - Detection of Aging Effects. The GALL Report identifies the following recommendation for "detection of aging effects" program element associated with the exception taken:

> Periodic inspection of susceptible locations to confirm that coating and wrapping are intact. The inspections are performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems. Because the inspection frequency is plant specific and also depends on the plant operating experience, the applicant's proposed inspection frequency is to be further evaluated for the extended period of operation.

Exception: The GALL Report refers to periodic inspections with a scheduled frequency; however, BSEP intends to inspect buried piping excavated during maintenance activities. Excavating components solely to perform inspections poses undue risk of damage to protective coatings. Operating experience indicates that the frequency of excavating buried piping for maintenance activities is sufficient to provide reasonable assurance that the effects of aging will be identified prior to the loss of intended function.

The staff noted that the applicant plans to perform periodic buried piping inspections that will be opportunistic inspections performed during maintenance activities. The staff informed the applicant that opportunistic inspections qualify; however, there must also be a commitment to perform periodic inspections at least once every ten years during the license extension period. Opportunistic inspections can qualify for the periodic inspections.

As documented in the staff's Audit and Review Report, the applicant committed to revise the Buried Piping and Tanks Inspection Program to perform periodic inspections of buried piping (see Commitment Item #13). The applicant stated that opportunistic inspections may be used to satisfy inspection requirements, but in no case will the frequency of inspection exceed 10 years.

The staff reviewed the applicant's response and determined that, with the commitment to perform periodic inspections at least once every 10 years, the applicant's program is consistent with the GALL Report.

On the basis of its review of the program elements, and discussions with the applicant's technical staff, the staff concluded that those program elements in the Buried Piping and Tanks Inspection Program for which the applicant claims consistency with GALL AMP XI.M34 are consistent with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that industry operating experience has shown that carbon steel and cast iron buried components have experienced corrosion degradation. Critical areas include the interface at which the component transitions from above ground to below ground. This is an area where coatings are often missing or damaged.

The applicant also stated that leaks have occurred in buried piping components and have been repaired, which demonstrates that leaks have been detected and that appropriate corrective actions have been taken, demonstrating the applicant's ability to ensure no loss of component

intended function in the period of extended operation. BSEP conducts pressure tests of safety-related service water system buried piping to ensure adequate flow delivery and technical specification operability.

The applicant concluded that, based on plant operating experience, scheduled, periodic excavations of buried piping for inspection are not warranted. As additional operating experience is obtained, lessons learned may be used to adjust this program.

The staff asked the applicant how operating experience is captured. The applicant indicated that plant procedure, Operating Experience Program, is used to increase personnel's awareness of plant and industrial operating experience so that lessons learned can be used to adjust its AMP, as necessary. In its procedure, the applicant stated that it provides guidance for using, sharing, and evaluating operating experience at NGG sites as well as promoting the identification and transfer of lessons learned by the industry. The staff reviewed the applicant's procedure and determined that the procedure is acceptable.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the staff concludes that the applicant's Buried Piping and Tanks Inspection Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.17, the applicant provided the UFSAR supplement for the Buried Piping and Tanks Inspection Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.14 ASME Section XI, Subsection IWL Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.19, "ASME Section XI, Subsection IWL Program " In the LRA, the applicant stated that this is an existing program that is consistent, with exception, with GALL AMP XI.S2, "ASME Section XI, Subsection IWL Program."

In the LRA, the applicant stated that this program consists of periodic visual inspection of reinforced concrete containment structures. The program is 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. The BSEP concrete containments do not utilize a post-tensioning system; therefore, the ASME

Code, Section XI, Subsection IWL requirements associated with a post-tensioning system are not applicable.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exception and the associated justifications to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP's consistency with GALL AMP XI.S2.

In LRA Section B.2.19, the applicant stated an exception to an element of the AMP in the GALL Report, as follows.

Exception - Scope of Program. The GALL Report identifies the following recommendation for the "scope of program" program element associated with the exception taken:

> Subsection IWL-1000 specifies the components of concrete containments within its scope. The components within the scope of Subsection IWL are reinforced concrete and unbonded post-tensioning systems of Class CC containments, as defined by CC-1000.

Exception: The BSEP concrete containments do not utilize a post-tensioning system. Therefore, the ASME Section XI, Subsection IWL requirements associated with a post-tensioning system are not applicable and are excluded from the program.

Since the containment is a reinforced concrete design, and not a prestressed concrete design, the provisions of IWL for inspection of unbonded post-tensioning systems are not applicable to BSEP.

On the basis of its review of the above exception and discussions with the applicant's technical staff, the staff concluded that the exception stated by the applicant for the ASME Section XI, Subsection IWL Program to the program element for GALL AMP XI.S2 is acceptable.

Operating Experience. In the LRA, the applicant stated that the ASME Section XI, Subsection IWL Program is implemented and maintained in accordance with the general requirements for engineering programs. This provides assurance that the programs (1) are effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews; (2) have qualified personnel assigned as program managers with authority and responsibility to implement the program; (3) have adequate resources committed to program activities; and (4) are managed in accordance with plant administrative controls.

The applicant also stated that plant-specific operating experience has identified numerous assessments, performed on both a plant-specific and corporate basis, dealing with program development, effectiveness, and implementation. The ASME Section XI, Subsection IWL Program is continually being upgraded based upon industry and plant-specific experience. Additionally, plant operating experience is shared between Progress Energy sites through regular

peer group meetings, a common corporate sponsor, and outage participation of program managers from other Progress Energy sites.

The staff did not identify any documented occurrences of containment concrete degradation in its review of plant-specific operating experience. Based on discussions with the applicant's technical staff, there have been no occurrences of containment concrete degradation observed.

On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the staff found that the applicant has adequately considered operating experience, consistent with the guidance in the GALL Report.

UFSAR Supplement. In LRA Section A.1.1.19, the applicant provided the UFSAR supplement for the ASME Section XI, Subsection IWL Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.15 ASME Section XI, Subsection IWF Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.20, "ASME Section XI, Subsection IWF Program." In the LRA, the applicant stated that this is an existing program that is consistent, with enhancement, with GALL AMP XI.S3, "ASME Section XI, Subsection IWF."

In the LRA, the applicant stated that this program provides for visual examination of 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, which provide for visual examination of inservice inspection Class 1, 2, 3, and MC supports in accordance with the requirements of ASME Section XI, Subsection IWF, 1989 Edition, and ASME Code Case-491.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the enhancement and the associated justifications to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP elements' consistency with GALL AMP XI.S3.

In the LRA, the applicant stated the following enhancement to meet the GALL Report program element:

Enhancement - Scope of Program. The GALL Report identifies the following criterion for the "scope of program" program element associated with the enhancement:

> Starting with the 1990 addenda to the 1989 edition, the scope of Subsection IWF was revised. The revised percentages are 25% of Class 1 nonexempt piping supports, 15% of Class 2 nonexempt piping supports, 10% of Class 3 nonexempt piping supports, and 100% of supports other than piping supports (Class 1, 2, 3, and MC)..... For multiple components other than piping, within a system of similar design, function, and service, the supports of only one of the multiple components are required to be examined.

Enhancement: The torus vent system supports are to be included within the scope of the ASME Section XI, Subsection IWF Program (see Commitment Item #14).

During the audit, the staff asked the applicant whether the torus vent system supports are the only Class MC supports, and if not, to describe the other Class MC supports. The staff also inquired whether Class MC supports are currently in the scope of IWF.

The applicant stated that the torus vent system supports are the only Class MC supports. In a discussion with the applicant's technical staff, the staff determined that the torus vent system supports are currently included within the scope of the applicant's IWE program.

On the basis of its review of the program elements, and discussions with the applicant's technical staff, the staff concluded that those program elements in the ASME Section XI, Subsection IWF Program for which the applicant claims consistency with GALL AMP XI.S3 are consistent with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that the ASME Section XI, Subsection IWF Program is implemented and maintained in accordance with the general requirements for engineering programs. This provides assurance that the programs (1) are effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews; (2) have qualified personnel assigned as program managers, with authority and responsibility to implement the program; (3) have adequate resources committed to program activities; and (4) are managed in accordance with plant administrative controls.

The applicant also stated that plant-specific operating experience has identified numerous assessments, performed on both a plant-specific and corporate basis, dealing with program development, effectiveness, and implementation. The ASME Section XI, Subsection IWF Program is continually being upgraded based on industry and plant-specific experience. Additionally, plant operating experience is shared between Progress Energy sites through regular peer group meetings, a common corporate sponsor, and outage participation of program managers from other Progress Energy sites.

Based on discussions with the applicant's technical staff, the staff determined that there are no augmented inspections currently being performed for supports in the scope of the applicant's IWF program. The staff noted that LRA Section 4.7.4 describes a TLAA for the torus vent system supports which stated that there are inaccessible areas associated with non-ASME, Section XI,

ISI component supports in the torus (immersed and in vapor environment) that were unable to be coated and are addressed in this analysis. The inaccessible areas of the lower column support for the vent header, located in immersed and vapor zones, were not coated and did not meet the minimum thickness requirement for the 60-year service period. These supports require aging management activities for the 60-year service period. An inspection of the pipe wall thickness of the 6-inch diameter lower column support is required prior to the period of extended operation. The planned inspection method will be a representative volumetric (UT) examination of the wall, with a comparison to the design-basis minimum thickness requirement. Based on results, follow-up actions will be taken, as necessary, including further examinations or replacement of components.

The staff noted that the supports in question will be added to the scope of BSEP AMP B.2.20, ASME Section XI, Subsection IWF Program, prior to the extended period of operation, but that IWF only specifies periodic visual inspection of supports, and inaccessible areas are generally exempted from inspection. Consequently, inspection to IWF requirements will not provide any useful results concerning the remaining wall thickness of the supports.

During the audit, the staff requested that the applicant describe any augmented inspections that may be implemented under the IWF program to provide useful information about the remaining wall thickness of the vent header supports. The applicant stated that the determination of an augmented inspection would be contingent on the results of the TLAA, one-time inspection, and ultrasonic examination of the component. If an unacceptable corrosion rate is detected, an augmented IWF inspection, utilizing an ultrasonic examination, would most likely be created to manage the subject components.

The staff determined that the applicant's approach to assessing the need for augmented inspection under IWF is appropriate and acceptable. On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the staff found that the applicant has adequately considered operating experience, consistent with the guidance in the GALL Report.

UFSAR Supplement. In LRA Section A.1.1.20, the applicant provided the UFSAR supplement for the ASME Section XI, Subsection IWF Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's ASME Section XI, Subsection IWF Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff has reviewed the enhancement and confirmed that the implementation of the enhancement prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 Masonry Wall Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.22, "Masonry Wall Program." In the LRA, the applicant stated that this is an existing program that is consistent, with the enhancement, with GALL AMP XI.S5, "Masonry Wall Program."

In the LRA, the applicant stated that this program is based on guidance provided in NRC IE Bulletin 80-11, "Masonry Wall Design," and is implemented through corporate procedure. The program provides for inspections of masonry walls within the scope of license renewal for cracking. Masonry walls within the service water building, reactor building, augmented off-gas building, diesel generator building, control building, and turbine building are within the scope of the Masonry Wall Program. This group includes the masonry walls identified as in proximity to or having attachments to SR components in response to Bulletin 80-11. The program is a condition monitoring program with the inspection frequencies established such that no loss of intended function would occur between inspections.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the enhancement and the associated justifications to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP's consistency with GALL AMP XI.S5.

In the LRA, the applicant stated the enhancement to this program to meet the GALL Report elements:

Enhancement - Parameters Monitored/Inspected. The GALL Report identifies the following guidance for the "parameters monitored/inspected" program element associated with the enhancement:

> The primary parameter monitored is wall cracking that could potentially invalidate the evaluation basis.

Enhancement: The inspection attribute "cracking" in the program procedure will be revised to remove the restriction on inspecting the walls within 1 foot of wall penetrations or of floor, ceiling, or lateral support connections when assuring the absence of cracks (see Commitment Item #15).

The staff determined that the applicant plans to revise the program procedure by removing the restriction on inspecting the walls within 1 ft of wall penetrations or floor, ceiling, or lateral support connections when assuring the absence of cracks is consistent with the recommendations in the GALL AMP XI.S5.

On the basis of its review of the program elements, and discussions with the applicant's technical staff, the staff concluded that those program elements in the Masonry Wall Program for which the

applicant claims consistency with GALL AMP XI.S5 are consistent with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that the Masonry Wall Program has provided for the detection of cracks and other minor aging effects in masonry walls. The corrective action process has ensured the program is implemented consistent with the BSEP design basis. A Licensee Event Report 1-92-012, "Emergency Diesel Generator Building Internal Wall Seismic Support Bolting was Defectively Installed during Plant Construction," required a reevaluation of the original response to Bulletin 80-11. The reevaluation was implemented in strict compliance with Bulletin 80-11 and resulted in a scope expansion from 86 SR masonry walls in the original response to 153 SR walls. Structural monitoring programs are continually being upgraded based upon industry and Progress Energy plant experience. Operating history has shown the Masonry Wall Program to be an effective management tool based on the frequency and acceptable results of past inspections.

The staff asked the applicant how operating experience is captured. The applicant indicated that plant procedure, Operating Experience Program, is used to increase personnel's awareness of plant and industrial operating experience so that lessons learned can be used to adjust its AMP, as necessary. In its procedure, the applicant stated that it provides guidance for using, sharing, and evaluating operating experience at NGG sites as well as promotes the identification and transfer of lessons learned from industry. The staff reviewed the applicant's procedure and determined that the procedure is acceptable.

On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the staff found that the applicant has adequately considered operating experience, consistent with the guidance in the GALL Report.

UFSAR Supplement. In LRA Section A.1.1.22, the applicant provided the UFSAR supplement for the Masonry Wall Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Masonry Wall Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff has reviewed the enhancement and confirmed that the implementation of the enhancement prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.17 Structures Monitoring Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.23, "Structures Monitoring Program." In the LRA, the applicant stated that this is an existing program that is consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program."

In the LRA, the applicant stated that this program manages the aging effects of civil commodities within the scope of license renewal. The Structures Monitoring Program is implemented, through procedures, in accordance with the regulatory requirements and guidance associated with the MR, 10 CFR 50.65; NRC Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, and NEI (NUMARC) 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2. The applicant also stated that the program incorporates criteria recommended by the 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 experience and recommendations from American Concrete Institute (ACI) 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 consists of periodic inspection and monitoring of the condition of structures and structure component supports to ensure that aging degradation leading to loss of intended functions will be detected and that the extent of degradation can be determined.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP elements' consistency with GALL AMP XI.S6.

The staff noted that LRA Appendix B, Table B-1, indicates that GALL AMP XI.S7 is not credited for aging management of water control structures. The staff asked the applicant if the Structures Monitoring Program includes the program elements of GALL AMP XI.S7 to manage aging of water control structures, as specified as an option in the GALL Report, and whether it is completely consistent with GALL AMP XI.S7.

The applicant stated the CLB does not credit RG 1.127. The service water building is managed by the maintenance rule procedure, Condition Monitoring of Structures, which is the primary implementing procedure for the Structures Monitoring Program. The Structures Monitoring Program is credited for the management of all other structures and was found to be effective for management of the service water building, as evidenced by plant operational experience. As such, the service water building was categorized with the generic Note E (Consistent with the GALL Report for material, environment, and aging effect combination, but a different AMP is credited).

As a follow-up to the applicant's initial response, the staff requested that the applicant (1) identify all structures, components, and plant features (e.g., canals) that are essential to maintaining an adequate supply of cooling water for safe shutdown; (2) identify the AMPs that will manage aging for each; and (3) identify how the credited AMP is consistent with the applicable program elements of GALL AMP XI.S7.

The applicant stated that both the intake canal (including sheet-pile cellular bulkhead surrounding the service water intake structure) and the service water intake structure are managed by the

Structures Monitoring Program. The intake canal is managed by the Structures Monitoring Program, which specifically includes guidance from RG 1.127 (Reference Attachment 1, sheet 5 of 6, EGR-NGGC- 0351).

The Structures Monitoring Program will be clarified to specify that the inspection interval for the intake canal is not to exceed five years and, based on a comparison, the Structures Monitoring Program effectively envelopes the inspection attributes of RG 1.127, with the exception of inspection frequency, as it relates to the service water intake structure (see Commitment Item #16). The Structures Monitoring Program specifies an inspection frequency commensurate with the safety significance of the structure and its condition, but shall not exceed ten years. RG 1.127 specifies an inspection frequency not to exceed five years. The Structures Monitoring Program will be enhanced to change the inspection frequency for the service water intake structure to not exceed five years (see Commitment Item #16).

As documented in the staff's Audit and Review Report, the applicant has also committed, by letter dated March 14, 2005, to enhance the Structures Monitoring Program to inspect the submerged portions of the service water intake structure at least once every five years (see Commitment Item #16).

Based on the applicant's commitment to inspect the service water intake structure (including submerged portions), intake canal and sheet piles at least once every five years, and the staff's comparison of program elements, the staff concluded that the applicant's Structures Monitoring Program includes the necessary program elements of GALL AMP XI.S7 and is acceptable to manage aging of the service water intake structure (including submerged portions), intake canal, and steel piles.

In LRA Section B.2.23, the applicant stated enhancements in meeting the GALL Report element as follows:

Enhancement 1 - Scope of Program The GALL Report recommends the following for the "scope of program" program element associated with the enhancement:

> The applicant specifies the structure/aging effect combinations that are managed by its structures monitoring program.

Enhancement: Administrative controls that implement the program will be revised to: (1) specifically identify the complete list of systems and structures that credit the program for aging management; (2) specifically define the inspection boundaries between the system and associated structure; and (3) notify the responsible engineer when below-grade concrete is exposed (see Commitment Item #16).

The staff asked the applicant to define the commodities, structures, and structural components currently in the scope of the Structures Monitoring Program. The applicant stated that the subject components are identified in LRA Section 3, Table 3.5.2-1 through 15. The staff also noted that the basis document, as documented in the staff's Audit and Review Report, identifies an enhancement to specifically include all systems that credit the program for aging management. The staff reviewed the referenced LRA tables, and concluded that the applicant has identified the commodities, structures, and structural components that credit the Structures Monitoring Program for aging management.

On this basis, the staff determined the applicant's enhancement to scope of program to be acceptable.

Enhancement 2 - Parameters Monitored/Inspected - The GALL Report recommends the following for the "parameters monitored/inspected" program element associated with the enhancement:

> For each structure/aging effect combination, the specific parameters monitored or inspected are selected to ensure that aging degradation leading to loss of intended functions will be detected and the extent of degradation can be determined.

Enhancement: Administrative controls that implement the program will be revised to (1) identify the following commodities within a condition monitoring group - battery racks, damper mounting, doors, electrical enclosures, fire hose stations, instrument supports, instrument racks; (2) include the following inspection attributes - wear (associated with doors), and sedimentation (associated with the intake canal); (3) require the responsible engineer to review the groundwater monitoring results against applicable parameters for determination of an aggressive below-grade environment; (4) require inspection of below-grade concrete when exposed by excavation; (5) specify that an increase in sample size for component supports shall be implemented (rather than should be) commensurate with the degradation mechanisms found, and (6) require an inspection of below-grade concrete, by the responsible engineer, prior to backfill (see Commitment Item #16).

During the audit, the staff reviewed the applicant's references to the Structures Monitoring Program in the AMR results for structures (LRA Section 3.5), and found them to be consistent with the above-listed enhancements to "parameters monitored/inspected."

The staff noted that inspection of below-grade concrete, when exposed by excavation, and periodic monitoring of ground water to ensure that it remains nonaggressive, are the key elements identified in the GALL Report for managing aging of below-grade concrete exposed to groundwater. However, the staff could not determine whether periodic groundwater monitoring is included in the Structures Monitoring Program scope. The listed enhancement only requires review of the results.

The staff requested that the applicant confirm that periodic monitoring of groundwater for aggressiveness will be conducted under the Structures Monitoring Program during the extended period of operation, and also to indicate whether this is currently part of the Structures Monitoring Program, or whether this is an enhancement to the Structures Monitoring Program. If monitoring of groundwater for pH, chlorides, sulfates and phosphates has been previously conducted, the staff requested the applicant to provide the quantitative results and an assessment of the aggressiveness of the groundwater based on comparison of the quantitative results to the recommendation in the GALL Report.

The applicant stated that periodic groundwater monitoring is currently being performed under an implementing procedure, as discussed in the staff's Audit and Review Report, which will be continued during the period of extended operation. An enhancement to the Structures Monitoring Program implementing procedure will be performed prior to the period of extended operation that requires the structures system engineer to review the groundwater monitoring results against the applicable parameters for determination of an aggressive below grade environment (see Commitment Item #16).

The applicant further stated that groundwater monitoring for pH, chlorides, and sulfates has been performed twice since 2002. The groundwater monitoring for phosphates was performed once and is not part of the groundwater monitoring program. The applicant presented a table, comparing the results against the recommendation in the GALL Report. The measured values for pH, chlorides and sulfates are well within the limits for non-aggressiveness.

The applicant's one-time inspection performed on well # ESS-3B, to determine a groundwater phosphate level, showed a value of 0.12 ppm. The staff noted that the GALL Report does not identify phosphates as an aggressive groundwater chemical and sets no limits.

The staff noted that the Structures Monitoring Program basis document and the referenced implementing procedure do not specifically define a frequency for periodic groundwater monitoring, to ensure non-aggressiveness. Current groundwater monitoring for other purposes is conducted annually; however, the parameters monitored do not include pH, chlorides, and sulfates as specified in the GALL Report.

The applicant stated that the Structures Monitoring Program will be enhanced to specify an annual frequency for groundwater monitoring to ensure non-aggressiveness. Attachment 8 of the implementing procedure identifies the monitored parameters, which include pH, chlorides and sulfates.

Including the applicant's additional enhancement to specify an annual frequency for groundwater monitoring, the staff determined that the applicant's enhancements to "parameters monitored/inspected" are acceptable, on the basis that they are necessary to manage aging of structures and structural components for which the applicant has credited the Structures Monitoring Program.

Enhancement 3 - Detection of Aging Effect. The GALL Report recommends the following for the detection of aging effect program element associated with the enhancement:

> For each structure/aging effect combination, the inspection methods, inspection schedule, and inspector qualifications are selected to ensure that aging degradation will be detected and quantified before there is loss of intended functions. Inspection methods, inspection schedule, and inspector qualifications are to be commensurate with industry codes, standards and guidelines, and are to also consider industry and plant-specific operating experience. Although not required, ACI 349.3R-96 and ANSI/ASCE 11-90 provide an acceptable basis for addressing detection of aging effects. The plant-specific structures monitoring program is to contain sufficient detail on detection to conclude that this program attribute is satisfied.

Enhancement: Revise the system engineer training materials to include the procedure regarding condition monitoring of structures as a procedure requiring In-depth knowledge (see Commitment Item #16).

During the audit the staff determined that this enhancement is acceptable on the basis that improved inspector qualifications will provide additional assurance that aging degradation will be detected and quantified before there is loss of intended functions, as prescribed in the GALL Report.

On the basis of its review of the program elements, and discussions with the applicant's technical staff, the staff concluded that those program elements in the Structures Monitoring Program for which the applicant claims consistency with GALL AMP XI.S6 are consistent with the GALL Report and, therefore, acceptable.

Operating Experience. In the LRA, the applicant stated that the Structures Monitoring Program incorporates best practices recommended by the INPO and inspection guidance based on industry experience and recommendations from ACI and ASCE. A review of inspection reports, self-assessments, and condition reports has concluded the administrative controls are effective in identifying age-related degradation, implementing appropriate corrective actions, and continually upgrading the administrative controls used for structures monitoring. The area surrounding the service water intake structure, adjacent to the intake canal, is subject to an aggressive environment due to high levels of chlorides and sulfates in the intake water. The service water intake structure is monitored on an increased frequency (every two years), due to the environment and history of degradation. The below-grade concrete and concrete below the intake canal water level are monitored from the building interior on a two-year frequency. Exterior concrete exposed to water is monitored annually below the waterline. Groundwater is monitored from various manholes and wells around the site, as well as the intake canal, for pH and the concentration of chlorides and sulfates. This information is provided to the responsible engineer and used to confirm the absence of an aggressive environment in the below-grade areas away from the intake canal.

The applicant's technical staff provided documentation of operating experience-related to concrete degradation of the Units 1 and 2 service water buildings (alternate designation for the service water intake structure). The information provided only covered occurrences of degradation for accessible interior and external concrete surfaces. Degradation was attributed to exposure to aggressive, raw service water. Repairs have been made.

During the review and audit, the staff requested the applicant to provide a summary of operating experience for submerged regions of the Units 1 and 2 service water buildings and for the intake canal and sheet piles.

The applicant stated that operating experience for the submerged portions of the service water intake structure is obtained from divers performing annual preventive maintenance. The only degradation observed was a minor spall of the concrete. No rebar was exposed and an evaluation determined the damage to be cosmetic. No repairs were required. The intake canal is monitored more frequently, with the depth studies typically conducted once per quarter and dredging typically conducted annually. Plant operating history has identified an issue with sedimentation buildup in front of the circulating traveling screens, which is managed by depth measurements and dredging.

The applicant also stated that thickness measurements have been performed on the sheet-pile bulkhead and the results found the area below the barnacle line is essentially the original design thickness. Minor thickness losses were identified above the barnacle line, but were not determined to have an impact on the structural integrity of the bulkhead. The area surrounding a diesel generator jacket water exhaust line penetration (approximately 8 feet above the barnacle line) was found to be 10 to 20 percent of the original design thickness with several through-walls. This degradation was originally identified by a maintenance rule structural inspection in 2002 and

work orders were created to perform ultrasonic measurements of the degraded areas. The results of the ultrasonic measurements are currently being evaluated for potential repair options.

The staff asked the applicant whether the annual preventive maintenance for the submerged portions of the service water intake structure and the intake canal quarterly depth studies and annual dredging are credited by and/or included in the Structures Monitoring Program.

The applicant stated that the Structures Monitoring Program will be enhanced to include inspections of the submerged portions of the service water intake structure on a frequency commensurate with RG 1.127, not to exceed five years; and (2) the majority of the intake canal volume is utilized by the circulating water system, which is not a license renewal system and is not required for safe shutdown. Monitoring of the intake canal on a quarterly frequency and annual dredging is primarily associated with operation of the circulating water system. The Structures Monitoring Program does credit the intake canal depth studies; however, dredging is based on the results of the depth studies and is not tied to any specific frequency. The implementing procedure for the intake canal depth studies recommends quarterly performance; however, the inspections may be deferred at the discretion of the E&RC supervisor based on operating experience.

On the basis of its review of the above plant-specific operating experience and discussions with the applicant's technical staff, the staff concludes that the applicant's Structures Monitoring Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA A.1.1.23, the applicant provided the UFSAR supplement for the Structures Monitoring Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Structures Monitoring Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff has reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 Protective Coating Monitoring and Maintenance Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.24, "Protective Coating Monitoring and Maintenance Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exception and enhancements, with GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program."

In the LRA, the applicant stated that the Protective Coating Monitoring and Maintenance Program is a condition monitoring program for Service Level I coatings applied inside the primary containment (drywell and torus) of Units 1 and 2. Coating parameters monitored include blistering, cracking, flaking, rusting, and other distress (indicated by peeling, undercutting, discoloration or physical damage). The program prevents clogging of ECCS suction strainers and containment spray nozzles by assuring that the quantity of damaged or degraded coatings inside primary containment that could detach during a loss-of-coolant accident remains within analyzed limits. The limits are based upon head loss calculations for ECCS suction strainers installed in the mid-1990s that quantify the amount of debris of various types, including insulation, corrosion products, and coating debris that can be tolerated without impairing system function. Specific limits apply for coating debris.

The program also performs in-process inspections for coating repairs and refurbishments to assure coatings are qualified. Unqualified coatings and damaged or degraded coatings are quantified and tracked on a coatings exempt log, and the cumulative total is compared to qualified limits.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exception and enhancements and the associated justifications to determine whether the AMP, with the exception and enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP elements' consistency with GALL AMP XI.S8.

As documented in the Audit and Review Report, the applicant stated that its Protective Coating Monitoring and Maintenance Program is based on a commitment to meet the requirements of Regulatory Guide 1.54, "Quality Assurance Requirements for Protective Coatings Applied to Water-Controlled Nuclear Power Plants," Revision 0, issued June 1973 (see Commitment Item #17). The GALL Report states that a comparable program for monitoring and maintaining protective coatings inside containment, developed in accordance with RG 1.54, Revision 0, is also acceptable as an AMP for license renewal. Therefore, the staff determined that the applicant's Protective Coating Monitoring and Maintenance Program was developed in accordance with a regulatory guide that is acceptable to the staff.

During refueling outages, the program performs inspections to determine if any existing qualified coatings were damaged or degraded during the previous operating cycle and provides for disposition of the damage. The program also performs in-process inspections for any Service Level I coatings applied during the refueling outage, and provides for the disposition of any unacceptable coatings. Disposition options include removal of discrepant coatings, repair or recoating, or entry on the coating exempt log for the applicable BSEP unit. The applicant updates the coating exempt logs during refueling outages by deleting any previously identified unqualified coatings that were removed, and adding any newly discovered unqualified coatings. The applicant performs engineering evaluations for the newly discovered unqualified coatings The coating exempt logs and engineering evaluations are maintained as quality assurance records.

The applicant monitors and controls the sludge, dirt, dust, rust, qualified paints, unqualified paints, and miscellaneous materials that could clog the ECCS suction strainers and containment spray nozzles. The staff noted that the Protective Coating Monitoring and Maintenance Program is used to manage the aging effects related to clogging the ECCS strainers; however, it only addresses the mass of qualified paints that could become debris.

During the audit, the staff asked the applicant what other programs are credited for other types of debris. As documented in the Audit and Review Report, the applicant responded that the Preventive Maintenance Program will be used to manage the amount of sludge, dirt/dust, rust, and other miscellaneous debris in the torus. The staff reviewed the applicant's response and determined that the applicant has identified those AMPs that manage aging effects that may contribute to the debris inside the primary containment.

In the LRA Section B.2.24, the applicant stated the following exception to the GALL Report elements.

Exception - Preventive Actions and Operating Experience The GALL Report identifies the following guidance for the program elements associated with the exception taken:

> Preventive Action: With respect to loss of material due to corrosion of carbon steel elements, this program is a preventive action.
>
> Operating Experience: NRC Generic Letter 98-04 describes industry experience pertaining to coatings degradation inside containment and the consequential clogging of sump strainers. RG 1.54, Rev. 1, was issued in July 2000. Monitoring and maintenance of Service Level I coatings conducted in accordance with Regulatory Position C4 is expected to be an effective program for managing degradation of Service Level I coatings, and consequently an effective means to manage loss of material due to corrosion of carbon steel structural elements inside containment.

Exception: The Protective Coating Monitoring and Maintenance Program is not credited within the license renewal review for prevention of corrosion of carbon steel.

The staff reviewed the associated AMRs in the LRA. The containment sump strainers are the only components in the plant that credit the Protective Coating Monitoring and Maintenance Program as an AMP. The degradation of the carbon steel components, which have applied coatings, is managed by other AMPs, such as the Water Chemistry, ASME Section XI Inservice Inspections, One-Time Inspection, System Monitoring, Preventive Maintenance, Above-Ground Steel Tanks, and Open-Cycle Cooling Water System Programs. The staff determined that not crediting the Protective Coating Monitoring and Maintenance Program for prevention of corrosion of carbon steel components is acceptable, since the aging of the affected components is being monitored by other staff-approved AMPs.

On the basis of its review of the above exception, and discussions with the applicant's technical staff, the staff concluded that the exception stated by the applicant for the Protective Coating Monitoring and Maintenance Program to the program elements for AMP XI.S8 in the GALL Report is acceptable.

In the BSEP LRA, the applicant stated that the following enhancements will be implemented prior to the period of operations to meet the GALL Report elements.

Enhancement 1 - Detection of Aging Effects. The GALL Report identifies the following guidance for the "detection of aging effects" program element associated with the enhancement:

> American Society for Testing and Material (ASTM) D 5163-96, paragraph 5, defines the inspection frequency to be each refueling outage or during other major maintenance outages as needed. ASTM D 5163-96, paragraph 8, discusses the qualifications for inspection personnel, the inspection coordinator and the inspection results evaluator. ASTM D 5163-96, subparagraph 9.1, discusses development of the inspection plan and the inspection methods to be used. It states, "A general visual inspection shall be conducted on all readily accessible coated surfaces during a walk-through. After a walk-through, thorough visual inspections shall be carried out on previously designated areas and on areas noted as deficient during the walk-through. A thorough visual inspection shall also be carried out on all coatings near sumps or screens associated with the emergency core cooling system (ECCS)." This subparagraph also addresses field documentation of inspection results. ASTM D 5163-96, subparagraph 9.5, identifies instruments and equipment needed for inspection.

Enhancement: Program administrative controls will be enhanced to: (a) add a requirement for a walk-through, general inspection of containment areas during each refueling outage, including all accessible pressure-boundary coatings not inspected under the ASME Section XI, Subsection IWE Program; (b) add a requirement for a detailed, focused inspection of areas noted as deficient during the general inspection; and, (c) assure that the qualification requirements for persons evaluating coatings are consistent among the Service Level I coating specifications, inspection procedures, and application procedures, and meet the requirements of ANSI N101.4, "Quality Assurance for Protective Coatings Applied to Nuclear Facilities "(see Commitment Item #17).

Enhancement (1a) fulfills the GALL Report's guidance in that the inspection frequency will be every refueling outage. Enhancement (1b) fulfills the GALL Report's guidance that thorough visual inspections shall be carried out on areas noted as deficient during the walk-through. Enhancement (1c) fulfills the GALL Report's expectation that qualification requirements will be met for inspection personnel, the inspection coordinator, and the inspection results evaluator. The staff determined that these enhancements are consistent with the guidance provided in the GALL AMP XI.S.8. On the basis of its audit of the Protective Coating Monitoring and Maintenance Program and the associated GALL AMP, the staff determined that this enhancement is acceptable.

Enhancement 2 - Acceptance Criteria. The GALL Report identifies the following evaluation and technical basis for the "acceptance criteria" program element associated with this enhancement.

> ASTM D 5163-96, subparagraphs 9.2.1 through 9.2.6, 9.3 and 9.4, contain guidance for characterization, documentation, and testing of defective or deficient coating surfaces. Additional ASTM and other recognized test methods are identified for use in characterizing the severity of observed defects and deficiencies. The evaluation covers blistering, cracking, flaking, peeling,

delaminating, and rusting. ASTM D 5163-96, paragraph 11, addresses evaluation. It specifies that the inspection report is to be evaluated by the responsible evaluation personnel, who prepare a summary of findings and recommendations for future surveillance or repair, including an analysis of reasons or suspected reasons for failure. Repair work is prioritized as major or minor defective areas. A recommended corrective action plan is required for major defective areas, so that these areas can be repaired during the same outage, if appropriate.

Enhancement: Program administrative controls will be enhanced to document the results of inspections and compare the results to previous inspection results and to acceptance criteria. These activities are performed, but are not adequately incorporated into program procedures (see Commitment Item #17).

The enhancement of program administrative controls fulfills the GALL Report's expectation that inspection reports will be evaluated by the responsible evaluation personnel, who will prepare a summary of findings and recommend corrective actions, when required. The staff determined that the enhanced administrative controls will formalize current activities by requiring inspection results to be reviewed by the appropriate system engineer, who verifies that inspection findings meet acceptance criteria, and trends the inspection results in the PassPort database. On the basis of its audit of the Protective Coating Monitoring and Maintenance Program, the staff determined this enhancement to be acceptable as such changes to the applicant's program will *provide additional assurance that the effects of aging will be adequately managed.*

On the basis of its review of the above enhancements, and discussions with the applicant's technical staff the Protective Coating Monitoring and Maintenance Program AMP B.2.24 to make it consistent with the program elements for GALL AMP XI.S8 are acceptable.

Operating Experience. In the LRA, the applicant stated that the applicant's response to GL 98-04 described how the Protective Coating Monitoring and Maintenance Program complies with RG 1.54, Revision 0, which endorses ANSI N101.4-1972. The response described the program attributes, including design and licensing basis, procurement, control of coating application, quality assurance, monitoring, and maintenance of Service Level 1 coatings. It also explained that the protective coatings below the waterline in the torus of each unit were removed and replaced from 1994 to 1996. The replacement coatings were applied using materials, application methods, and quality assurance practices conforming to the requirements of ANSI N101.4-1972, "Quality Assurance for Protective Coatings Applied to Nuclear Facilities," ANSI N101.2-1972, "Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities," and ANSI N512-1974, "Protective Coatings (Paints) for the Nuclear Industry."

The applicant also stated that Service Level I protective coatings were determined to be within the scope of 10 CFR 50.65, the MR; and an MR monitoring system was created to manage ECCS suction strainer debris. Protective coatings are managed as a discrete subset of this maintenance rule debris management system. During refueling outages, inspections are performed to identify qualified coatings that were damaged or degraded during the previous operating cycle.

As documented in the Audit and Review Report, the applicant stated that BSEP installed larger ECCS strainers in the mid-1990s and prepared a detailed pump head loss calculation to determine acceptable ECCS strainer debris loading limits used in the program. Service Level 1

protective coatings are managed as a discrete subset of this maintenance rule debris management system. BSEP performed baseline inspections of Unit 1 and 2 containments. Unqualified and damaged coatings that were not removed at that time were logged on a coatings exempt log established for each unit. Engineering evaluations were performed to compare the cumulative total to the MR and design limits.

The applicant identified an increasing trend in the quantity of unqualified coatings remaining inside primary containment during the last outages for each unit. As a result, the applicant developed an integrated plan to address the removal of unqualified coatings inside the drywell and torus. While the quantity of unqualified coatings present is less than the applicable limits, this initiative is intended to further reduce the quantity of unqualified or degraded coatings remaining in place inside primary containment.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the staff concludes that the Protective Coating Monitoring and Maintenance Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.24, the applicant provided the UFSAR supplement for the Protective Coating Monitoring and Maintenance Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Protective Coating Monitoring and Maintenance Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications, and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the staff has reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.19 Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.2.26, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program." In the LRA, the applicant stated that this is a new program that is consistent, with exception, with GALL AMP XI.E2, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits."

In the LRA, the applicant stated that this program is credited for aging management of radiation monitoring and neutron flux monitoring instrumentation cables not included in the BSEP EQ

Program. Exposure of electrical cables to adverse localized environments caused by heat or radiation can result in reduced insulation resistance (IR). For circuits with a sensitive, high-voltage, low-level signal, such as radiation monitoring and nuclear instrumentation circuits, a reduction in IR is a concern because it may contribute to signal inaccuracies. For radiation monitoring instrumentation circuits, the results of routine calibration tests will be used to identify the potential existence of cable aging degradation. For neutron flux instrumentation circuits, field cables will be tested at least once every 10 years (see Commitment Item #19). Testing may include IR tests, time domain reflectometry (TDR) tests, current-versus-voltage (I/V) testing, or other testing judged to be effective in determining cable insulation condition.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exception and the associated justifications to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP elements' consistency with GALL AMP XI.E2 and BSEP plant procedure, CAP-NGGC-0202, "Operating Experience Program," Revision 8.

In its basis documentation, as documented in the Audit and Review Report, the applicant stated that the "parameters monitored/inspected," "detection of aging effects," and "acceptance criteria" program elements are not consistent with GALL XI.E2, but are consistent with the staff's proposed ISG-15, Revision of GALL AMP XI.E2, "Electrical Cables Not Subject to 10 CFR 50.49 Environment Qualification Requirement Used in Instrumentation Circuits."

During the audit, the staff noted that the basis documentation for the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (1) did not require a review of calibration or surveillance results for indication of cable degradation, as recommended by ISG-15; (2) was not clear as to whether or not cable testing included the cable connections; and (3) did not provide a basis for the10-year testing frequency for the neutron flux monitoring instrumentation circuits cable systems.

In response to staff questions, as documented in the Audit and Review Report, the applicant stated that it will revise the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program basis documentation and the LRA accordingly as follows:

> AMP B.2.26 will be revised to include a review of calibration or surveillance results for indication of cable degradation consistent with NRC Interim Staff Guidance (ISG)-15, Revision to Generic Aging Lessons Learned (GALL) Aging Management Program XI.E2. The first reviews will be completed before the end of the initial 40--year license term and at least once every 10 years thereafter
>
> Cable testing includes the entire cable system which includes cable connections, and state that the test frequency of the Neutron Monitoring System cable systems shall be determined based on engineering evaluation not to exceed ten years. The first test shall be completed prior to the end of the initial 40-year license term.

The staff reviewed the applicant's responses and, on the basis that these changes are consistent with ISG-15, the staff determined that the applicant's responses are acceptable.

In the LRA, the applicant stated the following exception to the program elements in the GALL Report:

The GALL Report identifies the following recommendation for "parameters monitored/inspected," "detection of aging effects," and "acceptance criteria" program elements associated with the exception taken:

> Parameters Monitored/Inspected. The parameters monitored are determined from the plant technical specifications and are specific to the instrumentation loop being calibrated, as documented in the surveillance testing procedure.
>
> Detection of Aging Effects. Calibration provides sufficient indication of the need for corrective actions by monitoring key parameters and providing trending data based on acceptance criteria related to instrumentation loop performance. The normal calibration frequency specified in the plant technical specifications provides reasonable assurance that severe aging degradation will be detected prior to loss of the cable intended function. The first tests for license renewal are to be completed before the period of extended operation.
>
> Acceptance Criteria. Calibration readings are to be within the loop-specific acceptance criteria, as set out in the plant technical specifications surveillance test procedures.

Exception: Direct cable testing will be performed as an alternative to instrument loop calibrations *for neutron flux monitoring instrumentation circuits*

In the LRA, the applicant stated that direct cable testing will be performed as an alternative to instrument loop calibrations for neutron flux monitoring instrumentation circuits. The staff reviewed the applicant's exception and determined that the exception is acceptable since it is consistent with the guidance in ISG-15, which states that either calibration results or findings of surveillance testing or direct testing of cable systems can be used to detect electrical cable aging degradation associated with the electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits.

On the basis of its review of the above exception, the staff concluded that the exception stated by the applicant for the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program to the program elements for GALL AMP XI.E2 is acceptable.

Operating Experience. In the LRA, the applicant stated that the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program is a new program with no Operating experience history. However, as noted in the GALL Report, industry Operating experience has shown that exposure of electrical cables to adverse localized environments caused by heat or radiation can result in reduced IR. Reduced IR causes an increase in leakage currents between conductors and from individual conductors to ground. A reduction in IR is a concern for circuits with sensitive, low-level signals such as radiation monitoring and nuclear instrumentation circuits, since it may contribute to signal inaccuracies.

The staff asked the applicant how operating experience is captured. The applicant indicated that a plant procedure, as documented in the Audit and Review Report, is used to train and increase personnel's awareness of plant and industrial operating experience so that lessons learned can be used to adjust its AMP, as necessary. In its procedure, the applicant stated that it provides guidance for using, sharing, and evaluating Operating experience at NGG sites and promotes the identification and transfer of lessons learned from industry. The staff reviewed the applicant's procedure and determined that the procedure is acceptable.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the staff concludes that the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.26, the applicant provided the UFSAR supplement for the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, which states:

> The electrical cables 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 neutron flux monitoring instrumentation cables not included in the BSEP EQ program. Exposure of electrical cables to adverse localized environments caused by heat or radiation can result in reduced insulation resistance (IR). A reduction in IR is a concern for circuits with sensitive, low-level signals, such as radiation monitoring and nuclear instrumentation circuits, since it may contribute to signal inaccuracies. For radiation monitoring instrumentation circuits, the results of routine calibration tests will be used to identify the potential existence of cable aging degradation. For neutron flux instrumentation circuits, field cables will be tested at least once every 10 years. Testing may include IR tests, time domain reflectometry (TDR) tests, current versus voltage (I/V) testing, or other testing judged to be effective in determining cable insulation condition. This program is consistent with the corresponding program described in NUREG-1801, with the exception that it allows direct cable testing for neutron flux monitoring circuits.

As documented in the Audit and Review Report, the applicant provided the following revised UFSAR supplement as part of its response to Question B.2.26-1:

> The Electrical Cables 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 neutron flux monitoring instrumentation cables not included in the BSEP EQ Program. Exposure of electrical cables to adverse localized environments caused by heat or radiation can result in reduced insulation resistance (IR). A reduction in IR is a concern for circuits with sensitive, low-level signals such as radiation monitoring and nuclear instrumentation circuits since it may contribute to signal inaccuracies. For radiation monitoring instrumentation circuits, the review of calibration results or findings of surveillance testing will be used to identify the potential existence of cable system aging degradation. This review will be performed at least once every 10 years and the first review will be completed before the end of the current license term. Cable systems used in neutron flux instrumentation circuits will be tested at a frequency

not to exceed 10 years based on engineering evaluation, and the first testing will be completed before the end of the current license term. Testing may include IR tests, time domain reflectometry (TDR) tests, current versus voltage (I/V) testing, or other testing judged to be effective in determining cable system insulation condition. This Program is consistent with the corresponding program described in NUREG-1801, as modified by NRC Interim Staff Guidance Issue No. 15, with the exception that it allows direct cable testing of neutron monitoring cable systems.

On the basis of its review of the revised UFSAR supplement for this program, the staff determined that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions and the associated justifications, and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 Reactor Coolant Pressure Boundary Fatigue Monitoring Program

Summary of Technical Information in the Application. This AMP is described in LRA Section B.3.1, "Reactor Coolant Pressure Boundary Fatigue Monitoring Program." In the LRA, the applicant stated that this is an existing program that is consistent, with exception and enhancements, with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary."

In the LRA, the applicant stated that this program includes preventive measures to mitigate fatigue cracking caused by anticipated cyclic strains in metal components of the reactor coolant pressure boundary. This is accomplished by monitoring and tracking the significant thermal and pressure transients for limiting reactor coolant pressure boundary components in order to prevent the fatigue design-limit from being exceeded. Also, the applicant stated that this program addresses the effects of the reactor coolant environment on component fatigue life by including, within the "scope of program" program element, 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," for older-vintage BWRs. These locations were evaluated by applying 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," for carbon and low-alloy steel; NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," for stainless steel; and methodology from Argonne National Laboratory for nickel-based alloys. Prior to exceeding the design limit, preventive and/or corrective actions are triggered by this program.

Staff Evaluation. During its audit, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the BSEP Audit and Review Report. The staff reviewed the exception and enhancements and the associated justifications to determine whether the AMP, with the exception and enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed the applicable documents in the staff's BSEP Audit and Review Report, which provide an assessment of the AMP elements' consistency with GALL AMP X.M1.

In LRA Section B.3.1, the applicant stated an exception to GALL AMP X.M1 program elements, as follows:

Exception - Monitoring and Trending. The GALL Report recommends the following for the "monitoring and trending" program element associated with the exception taken:

> The program monitors a sample of high fatigue usage locations. As a minimum, this sample is to include the locations identified in NUREG/CR-6260

Exception: The limiting locations selected for monitoring will be those with a 60-year CUF value (including environmental effects, where applicable) of 0.5 or greater. The monitoring sample may not include all locations identified in NUREG/CR-6260 that are within the scope of the program if they do not meet this criterion.

The staff considered the applicant's exception to be inconsistent with the GALL Report and requested that the applicant to clarify why all of the locations identified in NUREG/CR-6260 would not be included.

As documented in the Audit and Review Report, the applicant provided the following response:

> The BNP Fatigue Monitoring Program will be enhanced to monitor fatigue for each of the six locations from NUREG/CR-6260 applicable to the older-vintage General Electric plants, considering reactor water environmental effects. There will no longer be an exception to GALL Program Element 5-1 for Monitoring and Trending.

During the audit the staff reviewed this response and determined that the applicant's removal of this exception to the GALL Report is acceptable because BSEP will include all locations that meet the original criteria and the six locations identified in NUREG/CR-6260. The applicant's revision to the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, removing the original exception, will result in more locations being monitored by the program. The applicant has retained its 0.5 CUF criteria, but it does not apply to the six locations which will be included regardless of the predicted CUF.

In LRA Section B.3.1, the applicant stated the following enhancements to meet the program elements for AMP XI.M1 in the GALL Report:

Enhancement 1 - Scope of Program. The GALL Report recommends the following criterion for the "scope of program" program element associated with the enhancement:

> The program includes preventive measures to mitigate fatigue cracking of metal components of the reactor coolant pressure boundary caused by anticipated cyclic strains in the material.

Enhancement: Expand the scope of the current fatigue monitoring program to include the reactor coolant pressure boundary components beyond the Reactor Pressure Vessel (RPV), including the NUREG/CR-6260 locations outside the RPV (see Commitment Item #21).

The staff determined that the applicant's enhancement to the "scope of program" program element is necessary to ensure consistency with the GALL Report, and is acceptable.

Enhancement 2 - Preventive Actions. The GALL Report recommends the following criterion for the "preventive actions" program element associated with the enhancement:

> Maintaining the fatigue usage factor below the design code limit and considering the effect of the reactor water environment, as described under the program description, will provide adequate margin against fatigue cracking of reactor coolant system components due to anticipated cyclic strains.

Enhancement: Enhance the administrative controls of the Reactor Coolant Pressure Boundary Fatigue Monitoring Program to address preventive actions if an analyzed component is determined to be approaching the design limit, including an option to consider operational changes to reduce the number or severity of future transients affecting the component (see Commitment Item #21).

The staff determined that operational changes to reduce the number or severity of future transients affecting the component, if feasible, is one acceptable way for maintaining the fatigue usage factor below the design Code limit. The staff found this enhancement to be acceptable, as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3 - Monitoring and Trending. The GALL Report recommends the following recommendations for the "monitoring and trending" program element associated with the enhancement:

> The program monitors a sample of high fatigue usage locations. As a minimum, this sample is to include the locations identified in NUREG/CR-6260.

Enhancement: Include a requirement in the administrative controls of the Reactor Coolant Pressure Boundary Fatigue Monitoring Program to reassess the limiting locations that are monitored, considering the analyses for RCPB locations that were added to the program scope. Specify the selection criterion to be locations with a 60-year CUF value (including environmental effects where applicable) of 0.5 or greater.

The staff reviewed and determined that the 0.5 CUF selection criterion is acceptable for specifying additional sample locations, on the basis that it provides a margin to ensure that the applicant's program will include all locations having the potential to exceed 1.0 CUF at 60 years (see Commitment Item #21).

The staff found this enhancement to be acceptable as such changes to the Reactor Coolant Pressure Boundary Fatigue Monitoring Program will provide additional assurance that the effects of aging will be adequately managed.

Operating Experience. In the LRA, the applicant stated that a review was conducted of NRC INs, Bulletins, and GLs for the years 2000 through 2004, but no applicable Operating experience items were identified that relate to fatigue monitoring or to exceeding fatigue design-limits. The existing program has been effective in assuring that the fatigue analyses for the RPV components remain below the design limit of 1.0; the highest CUF value as of March 2001, was 0.354 (for the refueling bellows support), and the highest 40-year projected fatigue usage value was 0.53 (also for the refueling bellows support).

The staff asked whether a manual or automated methodology is used to calculate and update the CUF. In its response, the applicant stated that the current program utilizes a combination of interim CUF updates after each fuel cycle, along with a comprehensive fatigue usage analysis performed periodically, typically every 10 years. Both the interim updates and comprehensive fatigue usage analysis are performed manually. However, the comprehensive fatigue usage analysis is performed using the Fatigue-Pro Cycle Evaluation Module (CEM) to assess the impact of actual transient occurrences on the fatigue of limiting components. The Fatigue-Pro CEM method uses temperature and pressure data obtained from actual plant operations to determine the stresses resulting from operational transients. The transient data are supplied to the Fatigue-Pro CEM program manually.

The staff asked when the existing program was first implemented, whether any locations had been added or deleted, and which locations are currently monitored. The applicant stated that the current program, utilizing a combination of interim CUF updates and a comprehensive fatigue usage analysis, was implemented in the early 1990s. Over the life of the BSEP units, locations have been added and deleted, as documented in LRA Table 4.3-2. The locations currently monitored are the refueling bellows support, reactor vessel head closure studs, recirculation inlet nozzles, core spray nozzles, and feedwater nozzles.

The staff asked how starting CUFs were calculated when the program was first implemented, and how starting CUFs will be calculated for locations to be added to the program scope. The applicant stated that, as discussed in LRA Section 4.3.1, the original fatigue analyses were prepared in accordance with the ASME Code, Section III, 1965 Edition, with Addenda through Summer 1967, for Class A vessels. The fatigue analysis of the vessel flange was performed using the 1968 Edition of the Code. By 1981, the actual number of startup-shutdown cycles began to approach the number postulated in the design analyses, which required further evaluation. To address this issue, a fatigue usage update was performed for both units by General Electric (GE) in 1983. The GE evaluation determined that analysis of the five most limiting locations would bound the fatigue for the remaining components due to the relatively low design-fatigue usage values for the remaining components. The analyzed locations included the RPV head closure studs, recirculation inlet nozzles, core spray nozzles, Unit 1 feedwater nozzle, and refueling bellows support.

The applicant further stated that when the current program, utilizing a combination of interim CUF updates and a comprehensive fatigue usage analysis, was implemented; the plant cyclic data that characterized plant operations from original plant startup through 1992 were used as inputs to the Fatigue-Pro CEM program, and the fatigue usage to date for each component was computed.

Regarding additional components to be added to the scope of the program as a result of reactor coolant environmental effects, LRA Section 4.3.3 provides a summary of the CUF analyses for these components.

The staff asked whether the CUFs (including environmental effects) have already been projected to the end of the extended period of operation for the locations identified in NUREG/CR-6260, and, if already calculated, to identify the locations that will not be included in the program scope, based on the CUF greater-than-0.5 criterion. The applicant stated that, for each location identified in NUREG/CR-6260, CUF values have been projected to the end of the period of extended operation, including consideration of environmental effects, as shown in LRA Tables 4.3-3 and 4.3-4. Each of the locations identified in NUREG/CR-6260 will be included in the cycle evaluation module and will not be deleted based upon the CUF greater-than-0.5 criterion.

The staff reviewed the applicant's responses and concluded that the existing Reactor Coolant Pressure Boundary Fatigue Monitoring Program has been implemented in accordance with accepted technical practice for fatigue monitoring.

The staff reviewed the operating experience provided in the LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the staff concludes that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program will adequately manage the aging effects that are identified in LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.1.1.28, the applicant provided the UFSAR supplement for the Reactor Coolant Pressure Boundary Fatigue Monitoring Program (see Commitment Item #21).

As documented in the Audit and Review Report, as part of its response to a staff question, the applicant revised the UFSAR supplement to reflect its new commitment to include all sample locations specified in NUREG/CR-6260, independent of the 0.5 CUF selection criterion. The revised UFSAR supplement states that:

> The Reactor Coolant Pressure Boundary (RCPB) Fatigue Monitoring Program includes preventive measures to mitigate fatigue cracking caused by anticipated cyclic strains in metal components of the reactor coolant pressure boundary. This is accomplished by monitoring and tracking the significant thermal and pressure transients for limiting reactor coolant pressure boundary components in order to prevent the fatigue design limit from being exceeded. The 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," for older-vintage BWRs. This Program is consistent with the corresponding Program described in NUREG-1801.

Prior to the period of extended operation, the program will be enhanced to: (1) expand the Program scope to include an evaluation of each reactor coolant pressure boundary component included in NUREG/CR-6260, (2) provide preventive action requirements including requirement for trending and consideration of operational changes to reduce the number or severity of transients affecting a component, (3) include a requirement to reassess the locations that are monitored considering the RCPB locations that were added to the Program scope, (4) specify the selection criterion to be locations with a 60-year CUF value (including environmental effects where applicable) of 0.5 or greater, other than those identified in NUREG/CR-6260, (5) address corrective actions for components approaching limits, with options to include a revised fatigue analysis, repair or replacement of the component, or in-service inspection of the component (with prior NRC approval), and (6) address criteria for increasing sample size for monitoring if a limiting location is determined to be approaching the design limit.

The staff reviewed the revised UFSAR supplement for this section and determined that the information provided in the revised UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Reactor Coolant Pressure Boundary Fatigue Monitoring Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exception and the associated justifications, and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. Also, the staff has reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.21 Summary of Conclusions for AMPs That Are Consistent With the GALL Report with Exceptions or Enhancements

On the basis of its audit of the applicant's programs, the staff determined that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the related exceptions and enhancements to meet the GALL Report programs, and determined that the applicant 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).

On the basis of its review of the UFSAR supplement for these programs, the staff concluded that it provides an adequate summary description of the programs, as required by 10 CFR 54.21(d).