# Audit and Review Report

for

# Plant Aging Management

# Reviews and Programs

Brunswick Steam Electric Plant, Units 1 and 2
Docket Nos: 050000325, 050000324

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## TABLE OF CONTENTS

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## 1.0 Introduction and General Information

### 1.1 Introduction

In its letter dated October 18, 2004, (ADAMS Accession Number ML 043060406), Carolina Power & Light Company, 54), doing business as Progress Energy Carolinas, Inc., a subsidiary of Progress Energy, Inc., (the applicant) submitted to the U.S. Nuclear Regulatory Commission (NRC) its application for renewal of Operating Licenses DPR-71 and DPR-62 for Brunswick Steam Electric Plant (BSEP), Units 1 and 2, respectively. The applicant requested renewal of the operating licenses for an additional 20 years.

In support of the staff's safety review of the license renewal application (LRA) for BSEP, Units 1 and 2, the License Renewal and Environmental Impacts Program, Section B (RLEP-B), led a project team that audited and reviewed selected aging management reviews (AMRs) and associated aging management programs (AMPs) developed by the applicant to support the LRA for BSEP. The project team included both NRC staff and contractor personnel provided by Brookhaven National Laboratory (BNL), RLEP-B's technical contractor. Attachment 2 lists the project team members as well as other NRC staff and BNL personnel who supported the project team's review.

The project team performed its work in accordance with the requirements of Title 10 of the *Code of Federal Regulations*, Part 54 (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants"; the guidance provided in NUREG-1800, "Standard Review Plan for Review of License Renewal Application for Nuclear Power Plants" (SRP-LR), dated July 2001; the recommendations provided in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated July 2001.

Details of how the project team implemented these requirements and guidance are found in "Audit Plan For License Renewal Application Aging Management Programs Aging Management Review Results, Brunswick Steam Electric Plant, Units 1 and 2," (ML050110445). (BSEP Audit Plan).

Overall, for its assigned scope of work, the project team reviewed and determined that the applicant's aging management activities and programs will adequately manage the effects of aging on systems, structures, and components, so that their intended functions will be maintained for BSEP, Units 1 & 2, for the period of extended operation.

This audit and review report documents the results of the project team's audit and review work. The project team performed its work at NRC Headquarters, Rockville, Maryland; at BNL's offices in Upton, New York; and, at the applicant's Brunswick plant site offices in Southport, North Carolina. The project team conducted on-site visits during the weeks of January 10, 2005, and February 7, 2005. The team conducted a public exit meeting at the applicant's BSEP visitor's center in Southport, North Carolina on March 3, 2005. Attachment 2 lists the applicant's personnel and other individuals contacted by the project team in support of the work documented in this report. It also lists those attending the public exit meeting.

## 1.2 Background

In 10 CFR 54.4, the scope of license renewal is defined as those systems, structures, and components (SSCs): (1) that are safety-related; (2) whose failure could affect safety-related functions; or (3) that are relied on to demonstrate compliance with NRC regulations for fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram, and station blackout. An applicant for a renewed license must review all SSCs within the scope of license renewal to identify those structures and components (SCs) subject to an AMR. SCs subject to an AMR are those that perform an intended function without moving parts or without a change in configuration or properties, and that are not subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(3), an applicant for a renewed license must demonstrate that the effects of aging will be managed in such a way that the intended function or functions of those SCs will be maintained for the period of extended operation. 10 CFR 54.21(d) requires that the applicant submit a supplement to the Final Safety Analysis Report (FSAR) that contains a summary description of the programs and activities for managing the effects of aging.

The SRP-LR provides staff guidance for reviewing applications for license renewal. The GALL Report is a technical basis document. It summarizes staff-approved AMPs for the aging of a large number of SCs that are subject to an AMR. It summarizes the aging management evaluations, programs, and activities credited for managing aging for most of the SCs used by commercial nuclear power plants, and serves as a reference for both the applicant and staff reviewers to quickly identify those AMPs and activities that the staff have determined will provide adequate aging management during the period of extended operation. 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 identifies (1) SSCs, (2) component materials, (3) environments to which the components are exposed, (4) aging effects associated with the materials and environments, (5) AMPs that are credited with managing the aging effects, and (6) recommendations for further applicant evaluations of aging effects and their management for certain component types.

The GALL Report is treated in the same manner as an approved topical report that is generically applicable. An applicant may reference the GALL Report in its LRA to demonstrate that its programs correspond to those that the staff reviewed and approved in the GALL Report. If the material presented in the LRA is consistent with the GALL Report and is applicable to the applicant's facility, the staff will accept the applicant's reference to the GALL Report. In making this determination, the staff considers whether the applicant has identified specific programs described and evaluated in the GALL Report but does not conduct a re-review of the substance of the matters described in the GALL Report. Rather, the staff confirms that the applicant verified that the approvals set forth in the GALL Report apply to its programs.

If an applicant takes credit for a GALL AMP it is incumbent on the applicant to ensure that the plant AMP contains all the program elements of the referenced GALL AMP. These elements are described in the SRP-LR, Appendix A.1, "Aging Management Review - Generic (Branch Technical Position RLSB-1)." In addition, the conditions at the plant must be bounded by the conditions for which the GALL AMP was evaluated. The applicant must certify in its LRA that it completed the verifications and that they are documented and retained by the applicant in an auditable form.

The overall objective of this audit is to verify compliance with 10 CFR 54.21(a)(3). Therefore,

the audit and review process helps ensure that for each structure and component within the scope of the project team's review, the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The audit and review process for BSEP is described in the audit plan and is intended to accomplish the following objectives:

- For AMPs that the applicant claims are consistent with a GALL AMP, verify that the plant AMPs contain the program elements of the referenced GALL AMP (for the seven program elements that are within the scope of review of the project team) and that the conditions at the plant are bounded by the conditions for which the GALL AMP was evaluated.

- For AMPs that the applicant claims are consistent with a GALL AMP with exceptions, verify that the plant AMPs contain the program elements of the referenced GALL AMP and that the conditions at the plant are bounded by the conditions for which the GALL AMP was evaluated. In addition, verify that the applicant has documented an acceptable technical basis for each exception.

- For AMPs that the applicant claims will be consistent with a GALL AMP after specified enhancements are implemented, verify that the plant AMPs, with the enhancements, are consistent with the referenced GALL AMP, or are acceptable on the basis of a technical review. Also verify that the applicant identified the enhancements as commitments in the Updated Final Safety Analysis Report (UFSAR) or other docketed correspondence.

- For plant-specific AMPs that the applicant claims are consistent with AMPs that the staff has previously approved for another plant, verify the AMPs are acceptable on the basis of a technical review.

- For AMRs that the applicant claims are consistent with the GALL Report, verify that the plant AMRs are consistent with the criteria of the GALL Report or can be accepted on the basis on an NRC-approved precedent.

- If the GALL Report recommends further evaluation for a specific AMR line item, verify that the applicant has addressed the need for further evaluation, and evaluate the AMR in accordance with the SRP-LR.

### 1.3 Summary of Information in the BSEP License Renewal Application

The BSEP LRA closely follows the standard LRA format presented in Nuclear Energy Institute (NEI) guidance, NEI 95-10, "*Industry Guideline for Implementing the Requirements of 10 CFR Part 54 -- The License Renewal Rule*," Revision 4, April 2001. Section 3 of the BSEP LRA provides the results of the AMPs for SCs that the applicant identified as subject to an AMR. The major subsections of LRA Section 3 are:

3.1 AGING MANAGEMENT OF REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

3.2 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES

3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

3.4 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEMS

3.5 AGING MANAGEMENT OF CONTAINMENTS, STRUCTURES, AND COMPONENT SUPPORTS

3.6 AGING MANAGEMENT OF ELECTRICAL AND INSTRUMENTATION AND CONTROLS

### 1.3.1 BSEP LRA Tables

BSEP LRA Tables 3.0.1 and 3.0.2 provide descriptions of the internal and external service environments, respectively, used in the BSEP AMRs. Results of the AMRs are presented in two table types.

The first table type is Table 3.X.1, where the 3 indicates the table pertaining to the Chapter 3 AMR; the X indicates the table number from Volume 1 of the GALL Report (see the definition table below), and the 1 indicates that this is the first table type (Table 1) in Section 3.X. For example, in the reactor vessel, internals, and reactor coolant system subsection, this is Table 3.1.1, and in the engineered safety features systems subsection, this is Table 3.2.1.

**Table 1.3-1 Listing of NUREG-1801 Volume 1 Subsections**

| X | NUREG-1801 Volume 1 Subsections |
|---|---|
| 1 | Reactor Coolant System |
| 2 | Engineered Safety Features Systems |
| 3 | Auxiliary Systems |
| 4 | Steam and Power Conversion Systems |
| 5 | Structures and Component Supports |
| 6 | Electrical and Instrumentation and Controls |

The second table type is Table 3.X.2-Y where 3 again indicates the BSEP LRA section number; X again indicates the table number from Volume 1 of the GALL Report; the 2 indicates that this is the second table type (Table 2) in Section 3.X; and Y indicates the system table number. For example, within the reactor coolant system subsection, the AMR results for the reactor vessel and internals are presented in Table 3.1.2-1, and the results for the reactor vessel internals are in Table 3.1.2-2. In the engineered safety features subsection, the residual heat removal system results are presented in Table 3.2.2-1, and the containment atmosphere control system results are in Table 3.2.2-2.

### 1.3.2 Description of Table Formats

The GALL Report contains the staff's generic evaluation of existing plant programs to manage aging. It 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, within the scope of license renewal, without change. The report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. In order to take full advantage **of NUREG-1801, the applicant has made a comparison between the plant-specific AMR results and the generic evaluations presented in the GALL report. The results of that comparison are provided in two table formats, which are described below.**

1.3.2.1 Overview of BSEP LRA Table 1

The BSEP LRA Table 1 provides a summary comparison of how the BSEP AMR results align with the corresponding tables of the GALL Report. The BSEP LRA Table 1 consists of the following columns: "Item Number","Component", "Aging Effect/Mechanism", "AMPs", "Further Evaluation Recommended" and "Discussion" . These BSEP LRA tables have the same format and are essentially the same as Tables 1 through 6 of the GALL Report, except that the "Type" column of the GALL Report tables was replaced by an "Item Number" column and the "Item Number in GALL" column of the GALL Report tables was replaced by a "Discussion" column. The "Discussion" column includes further clarifying/amplifying information. The following are examples of information that might be contained within the "Discussion" column:

(1) information on further evaluation required or reference to the location of that information

(2) the name of a plant-specific program being used

(3) exceptions to the GALL Report assumptions

(4) a discussion of how the line-item is consistent with the corresponding line-item in the GALL Report

(5) a discussion of how the line-item differs from the corresponding line-item in the GALL Report, when it may appear to be consistent

The format of Table 1 provides the reviewer **with a means of alignng a specific LRA Table 1 row with the corresponding NUREG-1801, Volume 1 table row, thereby facilitating a consistency check.**

1.3.2.2 Overview of BSEP LRA Table 2

The BSEP LRA Table 3.X.2-Y (Table 2) provides the detailed results of the AMRs for those components identified in BSEP LRA Section 2 as being subject to an AMR. There is 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 features system group contains tables specific to the residual heat removal, containment atmosphere control, high pressure coolant Injection, automatic depressurization, core spray, standby gas treatment, standby liquid control, HVAC control building, and reactor protection systems. Table 2 consists of the following nine columns:

(1) Component Type - The first column identifies the component types that are subject to an AMR. The component types are listed in alphabetical order. In the structural tables, component types are sub-grouped by material.

(2) *Intended Function* - The second column identifies the license renewal intended functions for the listed component types. Definitions and abbreviations of intended functions are listed in Table 2.0-1 in Section 2 of the BSEP LRA.

(3) *Material* - The third column lists the particular materials of construction for the component type being evaluated.

(4) *Environment* - The fourth column lists the environment to which the component types are exposed. Internal and external service environments are indicated. A description of these environments is provided in Table 3.0-1 Internal Service Environments, and Table 3.0.2, External Service Environments.

(5) *Aging Effect Requiring Management* - The fifth column lists the aging effects identified as requiring management for the material and environment combinations of each component type.

(6) *Aging Management Programs* - The sixth column lists the programs used to manage the aging effects requiring management.

(7) *GALL Report Volume 2 Item* - The seventh column documents identified consistencies of factors listed in Table 2 of the BSEP LRA with the GALL Report by noting the appropriate GALL Report item number. Each combination of the following factors listed in Table 2 is compared to the GALL Report to identify those consistencies: component type, material, environment, aging effect requiring management, and AMP. If there is no corresponding item number in the GALL Report for a particular combination of factors, Column 7 is left blank.

(8) *Table 1 Item* - The eighth column is a cross reference of line-items from Table 2 to Table 1. Each combination of the following that has an identified GALL Report item number also has a Table 1 line-item reference number: component type, material, environment, aging effect requiring management, and AMP. Column 8 lists the corresponding line-item from Table 1. If there is no corresponding item in the GALL Report Volume 1, Column 8 is left blank.

(9) *Notes* - The ninth column contains notes that are used to describe the degree of consistency with the line-items in the GALL Report. Notes that use letter designations are standard notes based on the letter from A. Nelson, NEI, to P. T. Kuo, NRC, "U.S. Nuclear Industry's Proposed Standard License Renewal Application Format Package, Request NRC Concurrence," dated January 24, 2003 (ML030290201). (Note that the staff concurred in the format of the standardized format for LRAs by letter dated April 7, 2003, from P.T. Kuo, NRC, to A. Nelson, NEI [ML030990052].) Notes that use numeric designators are specific to BSEP. The letter notes are described in detail in Section 1.3 of this report.

BSEP LRA Table 2 contains the AMR results and indicates whether the results correspond to a line-item in Volume 2 of the GALL Report. Correlations between the combination in the BSEP LRA Table 2 and a combination for a line-item in Volume 2 of the GALL Report are identified by the GALL Report item number in Column 7. If Column 7 is blank, the applicant did not identify a corresponding combination in the GALL Report. If the applicant identified a GALL Report line-item, the next column provides a reference to a Table 1 row number. This reference

corresponds to the GALL Report Volume 2 "roll-up" to the GALL Report Volume 1 tables. Many of the GALL Report evaluations refer to plant-specific programs. In these cases, the applicant considers the BSEP evaluation to be consistent with the GALL Report if the other elements are consistent. Any AMP suitable for management of a particular aging effect is considered to be consistent with the GALL Report program for line-items referring to a plant-specific or alternative program if it has been reviewed and determined to be consistent with the seven program elements (attributes) used to review the plant-specific program.

1.3.3 Table Usage

1.3.2.1 Use of Table 1

Each row in Table 1 is evaluated by moving from left to right across the table. Since the Component, Aging Effect/Mechanism, Aging Management Programs and Further Evaluation Recommended information is taken directly from the GALL Report, no further analysis of those columns is required. The information intended to help the reviewer the most in this table is contained within the Discussion column. Here the reviewer will be given information necessary to determine, in summary, how BSEP's evaluations and programs align with the GALL Report. This may be in the form of descriptive information within the Discussion column or the reviewer may be referred to other locations within the LRA for further information.

1.3.3.2 Use of Table 2

Table 2 contains the Aging Management Review information for the plant, whether or not it aligns with the GALL Report. Each row within the table provides the intended function, material, environment, aging effect requiring management, and aging management program combination for a particular component type within a system. In addition, if there is a correlation between the combination in Table 2 and a combination in the GALL Report, Volume 2, this is identified by a referenced item number in column seven. If the column contains "None," BSEP was unable to locate an appropriately corresponding combination in the GALL Report, Volume 2. Continuing across Table 2 from left to right within a given row, the next column is labeled Table 1 Item. If there is a reference number entered in this column, this reference number can be used to locate the corresponding row in Table 1 to see how the aging management program for this particular combination aligns with the GALL Report, Volume 1.

## 1.4 Audit and Review Scope

The AMRs and associated AMPs that the project team reviewed are identified in the BSEP audit and review plan. The project team examined a total of 29 AMPs and associated AMRs. The project team reviewed 28 AMPs and associated AMRs that the applicant claimed were consistent with the GALL Report. The project team also reviewed one plant-specific AMP.

The applicant noted that some of its AMPs, although described as consistent with the GALL Report, contain some deviations from the GALL Report. These deviations are of two types:

- Exceptions to the GALL Report - Exceptions are specified GALL criteria that the applicant does not intend to meet or implement.

- Enhancements - Enhancements are revisions or additions to plant procedures or program activities that the applicant will implement prior to the period of extended operation. Enhancements may expand, but not reduce, the scope of an AMP.

The project team reviewed all of the BSEP LRA Table 2s AMR line items in Chapter 3, except those assigned to the Office of Nuclear Reactor Regulation (NRR), Division of Engineering (DE) staff. Those the project team reviewed were either consistent with the GALL Report, as identified by Notes A through E in the BSEP LRA Table 3.X.2-Y (from Column 9 of the Table 2s discussed in Section 1.3 of this report), or reviewed and accepted by the project team on the basis of an NRC-approved precedent (see Section 1.5.3 below).

## 1.5 Audit and Review Process

The project team performed the audit and review process in accordance with the criteria defined in NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR) . Addition details on how the SRP-LR criteria were addressed are provided in the BSEP audit and review plan. This process is summarized below.

### 1.5.1 BSEP Aging Management Programs

For the BSEP AMPs for which the applicant claimed consistency with the AMPs in the GALL Report, the project team reviewed and determined consistency. The project team reviewed the BSEP AMP descriptions and compared 7 of the 10 program elements for those AMPs to the corresponding program elements for the GALL AMPs (Attachment 3 shows the 10 program elements from the SRP-LR). As discussed in the BSEP audit and review]plan, the project team did not review program elements 7, “Corrective Action,” 8, “Confirmation Process,” or 9, “Administrative Controls.” These elements were reviewed by the NRR Division of Inspection Program Management (DIPM) and the results documented in Section 3 of the safety evaluation report (SER) related to the BSEP LRA.

For AMPs that have one or more exception and/or enhancement, the project team reviewed each exception and/or enhancement to determine whether the exception and/or enhancement is acceptable and whether the BSEP AMP, as modified by the exception and/or enhancement, would adequately manage the aging effects for which it is credited. In some cases, the project team identified differences that the applicant did not identify between the BSEP AMPs credited by the applicant and the GALL AMPs. In these cases, the project team reviewed the difference to determine whether or not it is acceptable and whether or not the AMP, as modified by the difference, would adequately manage the aging effects.

For those BSEP AMPs that are not included in the GALL Report, the project team reviewed the AMP against the seven program elements within its review scope. The project team reviewed and determined whether these BSEP AMPs would manage the aging effects for which they are credited (see Section 1.5.3 below).

### 1.5.2 BSEP AMRs Results

The AMRs in the GALL Report fall into two board categories:

- those that the GALL Report concludes are adequate to manage aging of the components referenced in the GALL Report and

- those for which the GALL Report concludes that further evaluation is recommended for certain aspects of the aging management process.

The project team reviewed and determined that the AMRs results reported by the applicant to be consistent with the GALL Report are consistent with the GALL Report. The project also determined that the plant-specific AMRs results reported by the applicant to be justified on the basis of an NRC-approved precedent are technically acceptable and applicable. For AMRs results for which the GALL Report recommends further evaluation, the project team reviewed the applicant's evaluation to determine whether it adequately addresses the issues for which the GALL Report recommended further evaluation.

### 1.5.3 NRC-Approved Precedents

To help facilitate the staff review of its LRA, an applicant may reference NRC-approved precedents to demonstrate that its non-GALL programs correspond to reviews that the staff had approved for other plants during its review of previous applications for license renewal. When an applicant elects to provide precedent information, the project team determines whether the material presented in the precedent is applicable to the applicant's facility, determines whether the plant program is bounded by the conditions for which the precedent was evaluated and approved, and determines that the plant program contains the program elements of the referenced precedent. In general, if the project team determines that these conditions are satisfied, it will use the information in the precedent to frame and focus its review of the applicant's program.

It is important to note that precedent information is not a part of the LRA; it is supplementary information voluntarily provided by the applicant as a reviewer's aid. The existence of a precedent, in and of itself, is not a sufficient basis to accept the applicant's program. Rather, the precedent facilitates the review of the substance of the matters described in the applicant's program. As such, in its documentation of its reviews of programs that are based on precedents, the precedent information is typically implicit in the evaluation rather than explicit. If the project team determines that a precedent identified by the applicant is not applicable to the particular plant program for which it is credited, it may refer the program to the NRR DE for review in the traditional manner, i.e., as described in the SRP-LR, without consideration of the precedent information. As noted in Section 1.4 of this report, the applicant chose to provide precedent information to support its selection of certain BSEP programs. Therefore, some of the project team reviews documented in this audit and review report considered precedent information in the manner described above.

### 1.5.4 Updated Final Safety Analysis Review Supplement

Consistent with the SRP-LR, for the AMRs results and associated AMPs that it reviewed, the project team also reviewed the Updated Final Safety Analysis Review (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).

### 1.5.5 Documentation and Documents Reviewed

In performing its work, the project team relied heavily on the BSEP LRA, the SRP-LR, and the GALL Report. The project team also examined the applicant's precedent review documents and AMP basis documents (a catalog of the documentation used by the applicant to develop or justify its AMPs), and other applicant documents, including selected implementing procedures, to determine that the applicant's activities and programs will adequately manage the effects of aging on SCs.

Any discrepancies or issues discovered during the audit and review that required a formal response on the docket are documented in this audit and review report. If an issue was not docketed or was not resolved prior to issuing this audit and review report, a request for additional information (RAI) was prepared by the project team describing the issue and the information needed to disposition the issue. The RAI, if needed, is included and dispositioned in the SER related to the BSEP LRA. The list of RAIs associated with the audit and review is provided in Attachment 4 to this audit and review report.

Attachment 5 characterizes the nature and extent of the project team's reviews of the applicant's documents and lists the documents reviewed by the project team. During its on-site visits, the project team also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others personnel with technical expertise relevant to aging management.

### 1.5.6 Commitments to be Included in the Safety Evaluation Report

During the audit, the project team requested additional information to resolve issues related to the content of the LRA. In responding to these requests for additional information, the applicant, in some cases, committed to supplement its LRA to correct entries or implement additional activities, as needed, to appropriately manage aging of the various systems, components and structures in the scope of license renewal. A list of these commitments is included in Appendix 6 of this audit and review report.

## 1.6 Exit Meeting

The project team held a public exit meeting with the applicant on March 2, 2005, to discuss the results of its audits and reviews of the AMPs and AMRs results assigned to the project team. These discussions reflected the project team's work and its results, as documented in this audit and review report.

## 2.0 Aging Management Programs Audit and Review Results

The project team's audit and review activities for the BSEP AMPs and its conclusions regarding these programs are documented below. The audit and review was performed in accordance with the guidance contained in the BSEP audit and review plan as summarized in Section 1.5 of this audit and report.

### 2.1 ASME SECTION XI, INSERVICE INSPECTION, SUBSECTIONS IWB, IWC, AND IWD PROGRAM, (BSEP AMP B.2.1)

In BSEP LRA, Appendix B, Section B.2.1, the applicant states that BSEP AMP B.2.1, "ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program," is an existing plant program that is consistent with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

#### 2.1.1 Program Description

The applicant states, in the BSEP LRA, that 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."

The applicant also states that certain inspection requirements have been modified by the BSEP risk informed (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 Safety Evaluation Report dated November 28, 2001.

#### 2.1.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.2.1 is consistent with the GALL AMP XI.M1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.1, including BSEP calculation BNP-LR-606 "License Renewal Aging Management Program Description of the ASME Section XI, Subsections IWB, IWC, and IWD, Inservice Inspection (ISI) Program," Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M1.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.1 and associated bases documents against the GALL AMP XI.M1 for consistency.

During the audit and review, the project team noted that, in the program description section of BSEP AMP B.2.1, the applicant states that its ASME Section XI ISI 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. In response to a project team question regarding compliance with 10 CFR 50.55a, the applicant states the following:

> The Section XI, IWB/C/D program identifies those components, systems and their supports that are subject to examination and testing. 50.55a(g) allows for exceptions to access and pre service requirements for old plants, being that it is unreasonable to require an old plant to design ISI access into already constructed systems and to meet pre service requirements for already vaulted pre-service inspections. (The CPs for Units 1 and 2 were issued 2/7/70). Therefore, the exception that we cite in the LRA is allowed by and is quoted in 50.55a(g). See specifically 10 CFR 50.55a(g)(4) and 0BNP-TR-001, "Inservice Inspection Technical Report," Section 8.1.1, for additional information.

The project team reviewed and determined that the applicant's response is acceptable on the basis that it is in accordance with the requirements of 10 CFR 50.55a.

In the program description section of BSEP AMP B.2.1, the applicant states that certain inspection requirements have been modified by the BSEP RI-ISI program presented in EPRI TR-112657. The project team noted that the NRC staff 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. The project team informed the applicant that inspection modifications based on RI-ISI are not acceptable, and asked the applicant to revise its position on meeting the requirements of 10 CFR 50.55a and its modification of inspection requirements based on the BSEP RI-ISI program.

In its letter dated March 14, 2005 (ML050810493), the applicant states that it will comply with 10 CFR 50.55a for the extended period of operation. The applicant also states 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 Program is consistent with the corresponding program described in NUREG-1801.

The project team reviewed and determined that the applicants response is acceptable on the basis that currently approved relief requests and approved ASME Code Cases will not be used as a basis for modifying the applicant's commitment to implement 10 CFR 50.55a during the period of extended operation.

In reviewing the scope of this program, the project team noted that, in BSEP LRA Tables 3.2.2-3, 3.2.2-5, and 3.2.2-7, the applicant credits its ASME Section XI ISI 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 project team 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.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that BSEP will use the

water chemistry program and the ASME Section XI ISI 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 project team reviewed and determined that the applicant's response is acceptable on the basis that the approach is consistent with the GALL Report.

In the AMP element for detection of aging effects, the GALL Report states that the ASME Section XI ISI program includes inspections that can reveal crack initiation and growth, loss of material due to corrosion, coolant leakage, and indications of degradation due to wear or stress relaxation, such as verification of clearances, settings, physical displacements, loose or missing parts, debris, wear, erosion, or loss of integrity at bolted or welded connections. The project team asked the applicant to confirm that BSEP AMP B.2.1 includes the appropriate inspections.

In its response the applicant stated that the BSEP program includes periodic visual, surface, and/or volumetric examination and leakage tests of all Class 1, 2, and 3 pressure retaining components and their integral attachments. Inspection details are outlined in the implementing documents and sub-tier procedures.

The project team reviewed BSEP implementing documents OENP-16 "Procedure for Administrative Control of Inservice Inspection Activities," Rev. 43; OENP-16.2, "Administrative Control of ASME Section XI Non-Destructive Examination Program," Rev. 16; and, OENP-16.9 "Administrative Control of the ASME Section XI Pressure Testing Program," Rev. 13, and determined that these documents adequately implement the requirements related to NDE of Code Class 1, 2 and 3 components in accordance with the applicable ASME Section XI requirements. Based on the applicant's response, and review of the aforementioned documents, the project team reviewed and determined that the applicant's ASME Section XI ISI program adequately addresses the GALL Report recommendations for detection of aging effects.

In the AMP element for detection of aging effects, the GALL Report recommends that the guidance in BWRVIP-03 and BWRVIP-62 be followed in regard to NDE techniques for detecting aging in reactor vessel internals. The project team noted that these documents are not addressed in the applicant's AMP description or basis documents. Through discussions with the applicant, the project team reviewed and determined that the guidance of BWRVIP-03 is incorporated into BSEP procedure OPT-90.1, "Vessel Internal Component Remote Examinations." The BSEP BWRVIP program is administered under OENP-15, "Reactor Vessel & Internals Structural Integrity Program." Through discussions with the applicant, the project team also determined that BSEP does not credit inspection relief afforded by BWRVIP-62. Based on a review of the above documents, the project team reviewed and determined that, although it is not included in the ASME Section XI ISI program, the applicant implements the guidance in BWRVIP-03 in alternate programs and is consistent with the GALL Report.

In the AMP element for monitoring and trending, the GALL Report recommends that the inspection schedule specified in ASME Section XI (IWB-2400, IWC-2400, and IWD-2400), and the extent and frequency of IWB-2500-1, IWC-2500-1, and IWD-2500-1, be used since they provide for the timely detection of degradation. The project team noted that the inspection schedule is not addressed in the applicant's AMP description or basis documents. Through discussions with the applicant, the project team reviewed and determined that BSEP procedures OENP-16.2 and OENP-16.9 establish the schedule, extent, and frequency of the inspections. The project team reviewed these implementing documents and found that the inspection intervals are defined and that the program is in conformance with the requirements

of ASME Section XI, 1989 edition (no addenda). Therefore, the project team reviewed and determined that the applicants program is consistent with the monitoring and trending element in the GALL Report.

In the AMP element for acceptance criteria, the GALL Report recommends the use of appropriate ASME IWB/IWC/IWD guidance for acceptance criteria in evaluating inspection results. The project team noted that acceptance criteria are not addressed in the applicant's AMP description or basis documents. Through discussions with the applicant, the project team identified and reviewed BSEP implementing procedure OENP-16.2 and calculation BNP-LR-606. These documents confirm that the acceptance standards incorporated into the BSEP ASME Section XI ISI program for inspection of Class 1 or Class 2 and 3 components, are developed in accordance with the requirements of ASME Section XI, Subsections IWB-3400 and IWB-3500 or IWC-3400 and IWC-3500, respectively, as recommended by the GALL Report. On the basis of its review of these documents, and interviews with the BSEP staff, the project team reviewed and determined that the applicant's ASME Section XI ISI program is consistent with the recommendations for acceptance criteria in the GALL Report.

The project team reviewed those portions of the BSEP AMP B.2.1, "ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program," which the applicant claims is consistent with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.1.3 Exceptions to the GALL Report

None

2.1.4 Enhancements

None

2.1.5 Operating Experience

The applicant states, in the BSEP LRA, 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 states that a search of condition reports and ISI history, including self-assessments and inspections, was conducted and showed the BSEP ASME Section XI ISI program to be critically monitored and effective. Based on these results, the plant's operating experience (OE) program provides evidence that the program and maintenance practices are ensuring the continuing integrity of the ISI Class 1, 2 and 3 components.

The project team reviewed results of the operating experience review contained in calculation BNP-LR-011 "Operating Experience (OE) Review Of Materials and Programs for License Renewal," Rev. 0. The stated purpose of this document is to document a representative

sample of those operating events that validate the results of the aging effect evaluations or identify additional aging effects not previously determined by the standard method of aging management review. The applicant states, in the BSEP LRA, that this document provides reasonable assurance that the ISI program at BSEP is effective in the early identification and correction of various program deficiencies, including the expected component degradation identified through inspections that resulted in corrective actions, the identification of procedure and program deficiencies that were self-identified during routine program performance and corrected accordingly, and perceived program findings, weaknesses and items for consideration that were self-identified and resulted in evaluation and corrective action, as warranted.

The project team reviewed selected BSEP self-assessment and inspection reports to ascertain the effectiveness of the ISI program, including Progress Energy Nuclear Assessment Report B-ES-03-01, dated May 13, 2003, which presents a review of the ISI program (along with several other programs). As reported in this document, the BSEP self-assessment team identified no issues related to ISI program management or program implementation. This document stated that the self-assessment team witnessed and reviewed the ISI weld examination program (verified implementation of applicable code requirements and ensured component examination percentages were consistent with code requirements).

In addition to the BSEP self assessment, the project team reviewed a report documenting an inspection performed by NRC staff at BSEP on March 20, 2004. The report was an attachment to an NRC letter dated April 19, 2005 from V. McCree, NRC to C. Gannon, BSEP titled "Brunswick Steam Electric Plant - NRC Integrated Inspection Report No. 05000325/2004002 and 05000324/2004002; Preliminary White Finding." As part of that effort, the NRC inspectors reviewed ISI procedures, observed in-process ISI work activities, and reviewed selected ISI records. The inspectors observed portions of UT examinations on four welds to verify they were being performed acceptably. No findings of significance related to the ISI program were identified. The project team concluded that both documents reviewed support the applicants 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 project team concludes that the applicant's BSEP AMP B.2.1 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.1.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the ASME Section XI ISI program in the BSEP LRA, Appendix A, Section A.1.1.1. As discussed in Section 2.1.2 of this audit and review report, the UFSAR Supplement presented in the BSEP LRA includes reference to the applicants risk-informed (RI) ISI program. In response to a project team question, the applicant committed to removing references to the RI-ISI program, and to revising the UFSAR Supplement to read:

> The ASME Section XI, Inservice Inspection, Subsection IWB, IWC, and IWD Program consists of periodic volumetric, surface, and/or visual examination of components for assessment, signs of degradation, and corrective actions in accordance with applicable requirements and provisions of 10 CFR 50.55a. The program is consistent with the corresponding program described in NUREG-1801.

The project team reviewed the applicant's proposed revision to the UFSAR Supplement for AMP B.2.1, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP--LR UFSAR supplement table, and as required by 10 CFR 54.21(d).

### 2.1.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.2 WATER CHEMISTRY PROGRAM (BSEP AMP B.2.2)

In BSEP LRA, Appendix B, Section B.2.2 , the applicant states that BSEP AMP B.2.2, "Water Chemistry Program," is an existing plant program that is consistent with GALL AMP XI.M2, "Water Chemistry," with exceptions.

### 2.2.1 Program Description

The applicant states, in the BSEP LRA, 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. These guidelines address reactor water, condensate and feedwater, control rod drive cooling water, and spent fuel pool water. The water chemistry program includes periodic monitoring, control, and mitigation of known detrimental contaminants to maintain concentrations below the levels known to result in loss of material, cracking, and flow blockage.

### 2.2.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.2 is an existing program tha is consistent with GALL AMP XI.M2, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.2, including BSEP calculation BNP-LR-600, "License Renewal Aging Management Program Description of the Water Chemistry Program," Revision 1, which provides an assessment of the AMP's consistency with AMP XI.M2 in the GALL Report. The project team also reviewed implementing procedures, condition reports, program procedures, and BSEP Procedure 0AI-81, "Water Chemistry Guidelines," Revision 37.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.2 and associated bases documents against the GALL AMP XI.M2 for consistency.

During the audit and review, the project team noted that in the AMP element for scope, the applicant stated that the BSEP water chemistry program is based on BWRVIP-79, which recommends hydrogen water chemistry (HWC). However, BSEP calculation BNP-LR-600 states that BSEP is a normal water chemistry (NWC) plant. To clarify this discrepancy, the applicant stated in a letter dated March 14, 2005, (ML050810493) that BSEP is a HWC plant. Therefore, the basis document (BNP-LR-600) would be revised to reflect this. The project team reviewed and 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 element of this AMP.

In BSEP 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 project team asked the applicant to clarify how aging degradation of the aluminum demineralized water tank will be managed by the water chemistry program.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that:

> BSEP aging management reviews have identified that the demineralized water (MUD) tank is constructed of aluminum, and potentially susceptible to crevice, pitting and galvanic corrosion. BSEP had specified the water chemistry program, augmented by the one-time inspection program, to address this aging effect. BSEP performs routine internal visual inspections of the MUD 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 project team reviewed and 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 project team noted that in Table 3.3.2-7 of the BSEP LRA, 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. The project team asked the applicant to clarify how the water chemistry program would monitor the chemistry parameters in the standby liquid control tank with the presence of sodium pentaborate solution in the tank. In response the applicant stated that BSEP aging management reviews 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.

The project team reviewed and determined that the applicant's response is acceptable since

maintaining the water chemistry of the demineralized water tank will provide a reasonable means of controlling the contaminants present in the standby liquid control tank.

The project team reviewed those portions of the BSEP AMP B.2.2, "Water Chemistry Program," which the applicant claims is consistent with GALL AMP XI.M2, "Water Chemistry," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.2.3 Exceptions to the GALL Report

In Section B.2.2 of the BSEP LRA, the applicant identified the following exceptions to program elements in the GALL Report. The project team 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: NUREG-1801 recommends that water chemistry be controlled in accordance with BWRVIP-29. BWRVIP-29 references the 1993 revision of EPRI Report TR-103515, "BWR Water Chemistry Guidelines." The BSEP water chemistry program is based on the latest version of the BWRVIP Water Chemistry Guidelines (currently BWRVIP-79, EPRI Report TR-103515-R2, which is the 2000 Revision of "BWR Water Chemistry Guidelines"). EPRI incorporates new information to develop proactive plant-specific water chemistry programs to minimize intergranular stress corrosion cracking (IGSCC). EPRI periodically updates the water chemistry guidelines, as new information becomes available. The BSEP water chemistry program will be updated as revisions to the guidelines are released. The NRC staff has previously found EPRI TR-103515-R2 acceptable because the program is based on updated industry experience and plant-specific and industry-wide OE confirms the effectiveness of the water chemistry program.

The water chemistry program in the GALL report references the 1993 version of the "EPRI BWR Water Chemistry Guidelines," TR-103515, while the applicant currently employs Revision 2 of the EPRI guidelines, dated February 2000. This exception relates to the applicant's use of Revision 2 of the EPRI guidelines. The project team asked the applicant to clarify any significant differences between the NWC and HWC programs, and to discuss ISI results since the implementation of the HWC program.

In response, the applicant stated that there are two significant differences between BWRVIP-29 and BWRVIP-79. The first relates to the additional consideration of the beneficial effects of operation with hydrogen water chemistry (HWC). A key point discussed in BWRVIP-79 is that the HWC is an effective method for mitigating IGSCC by reducing corrosion potential. BWRVIP-79 provides an additional table (Table 4-5b) which allows relaxation of the power operation Action Level 3 values for chlorides and sulfates from 100 ppb to 200 ppb when HWC is in service and measured electrochemical potential (ECP) values are less than -230 mV (SHE). Also, BWRVIP-79 allows for higher Action Level 2 and Action Level 3 limits for chlorides and sulfates. However, BSEP limits are currently still in accord with BWRVIP-29 (or Table 4-5a of BWRVIP 79). The flexibility to use higher limits is warranted based on the increased protection of reactor coolant system and reactor assembly components provided by HWC.

The second significant difference involves the allowance in BWRVIP-79 for monitoring of chlorides and sulfates on less than a daily basis, when the criteria stated below are met (Note C of Table 4-5b of BWRVIP-79). The BWRVIP also states that this flexibility in monitoring frequency is acceptable when adequately justified and supported by the conductivity values and/or chemistry trends that assure that Action Level 1 limits will not be exceeded. At present, BSEP samples chlorides once every 72 hours at a minimum and sulfates once per week at a minimum.

The applicant further stated that a review of In-Vessel Visual Examination (IVVI) reports was performed and good results were observed during recent inspections. For example, a crack in Jet Pump Riser “G” RS-1 weld was examined during recent outages 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 Generic Letter 88-01, as modified by BWRVIP-75, have also had good results.

The applicant stated that it is important to maintain the flexibility to modify plant chemistry control procedures based on the best industry guidance developed from the collective operating experience of similar reactors. The BSEP water chemistry program will be updated as revisions to the guidelines are released, to develop a more proactive program that minimizes age-related degradation.

The project team reviewed and determined that the applicants response is acceptable since it is consistent with the recommendations provided in the EPRI-recommended HWC program, which is an enhancement to the GALL-recommended water chemistry program. Therefore, the project team 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 BSEP water chemistry program is credited with managing loss of material due

to galvanic corrosion and flow blockage due to fouling.

In the BSEP LRA certain aging management reviews (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 stress corrosion cracking. The parameter limits in effect are based upon 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 OE 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 and review the project team asked the applicant to explain how the BSEP 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 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 states that previous inspections of these components have shown that the water chemistry program is effective in managing this aging effect.

The project team 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 project team 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 BSEP water chemistry program does not require the monitoring of hydrogen peroxide, which is included in the description section of AMP XI.M2 in the GALL Report.

During the review and audit the project team 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 is 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 radiolysis model to estimate the hydrogen peroxide. Section 5.2.1.13 of BWRVIP-79 allows such use of models to estimate hydrogen peroxide and hence the determination of the ECP.

During the review and audit the project team reviewed and determined that the applicant's response is acceptable on the basis that, 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 project team 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 NRC staff has 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 above for Exception 1 (Scope of Program element) also pertains to this exception. The project team reviewed and 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 GALL-recommended water chemistry program.

The project team reviewed those portions of the BSEP AMP B.2.2, "Water Chemistry Program," which the applicant claims is consistent with GALL AMP XI.M2, "Water Chemistry," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.2.4 Enhancements

None

2.2.5 Operating Experience

The applicant states, in the BSEP LRA, 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) intergranular stress corrosion cracking has occurred in small and large-diameter BWR piping made of austenitic stainless steels and nickel-base 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 stress corrosion cracking (SCC) in piping and other components in standby liquid control systems exposed to sodium pentaborate solution has ever been reported.

The applicant also states 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, appropriate preventive measures were implemented to mitigate IGSCC in these systems, under the BWR stress corrosion cracking program.

The applicant's operating experience review in the LRA bases document (calculation BNP-LR-600) for the BSEP water chemistry program states that this program is continually upgraded based on industry experience and research. These continuous improvements assure the capability of the BSEP 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, no such degradation has been observed 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 project team concludes that the applicant's BSEP AMP B.2.2 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.2.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the water chemistry program in the BSEP LRA, Appendix A, Section A.1.1.2, which states that this program mitigates aging effects on component surfaces that are exposed to water as a process fluid. This program is used to control water chemistry for impurities (e.g., dissolved oxygen, chlorides, and sulfate) that accelerate corrosion and cracking. The program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below the system-specific limits. Alternatively, chemical agents, such as corrosion inhibitors, oxygen scavengers, and biocides, may be introduced to prevent certain aging mechanisms. The BSEP water chemistry program is currently based on the latest version of the EPRI guidelines in EPRI Report TR-103515-R2, February 2000, BWRVIP-79 for water chemistry in BWRs. The BSEP water chemistry program will be updated as revisions to the guidelines are released.

During the audit and review the project team noted that the applicant's UFSAR supplement does not indicate that the BSEP water chemistry program is credited to manage flow blockage due to fouling. Flow blockage is specifically identified in the BSEP LRA Appendix B, Section B.2.2, under "Program Description". When questioned by the project team the applicant stated that in NUREG-1800, Standard Review Plan for License Renewal, Tables 3.1-2, 3.2-2, 3.3-2, 3.4-2, and 3.5-2 contain standardized descriptions of the water chemistry program. None of these descriptions specifically describe the aging effects that are managed by the program. The program descriptions for other chemistry programs (fuel oil chemistry, closed-cycle cooling water system, open-cycle cooling water system) also do not contain a list of aging effects managed. The guidance provided by NEI 95-10, Revision 4, states: In some instances, summary descriptions of programs and activities already exist in the plant FSAR. The applicant may choose to incorporate these existing pages of the FSAR by reference or may choose to include them in the application.

Therefore, the applicant concluded that adding the aging effects managed by a particular program is below the level of detail required for a summary description in Appendix A, UFSAR Supplement and no change in the UFSAR Supplement is required. The project team concurred with the applicant's position since identifying all aging effects in the UFSAR is not required, as long as the applicable aging effects are addressed in the BSEP LRA.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.2, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table, and as required by 10 CFR 54.21(d).

2.2.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are

consistent with the GALL program. In addition, the project team has 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 project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.3 REACTOR HEAD CLOSURE STUDS PROGRAM (BSEP AMP B.2.3)

In BSEP LRA, Appendix B, Section B.2.3, the applicant states that BSEP AMP B.2.3, “Reactor Head Closure Studs Program," is an existing plant program that is consistent with GALL AMP XI.M3, “Reactor Head Closure Studs ."

### 2.3.1 Program Description

The applicant states, in the BSEP LRA, 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 1.65, “Materials and Inspections for Reactor Vessel Closure Studs,” 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, and loss of material due to: (1) general corrosion; (2) crevice corrosion; and, (3) pitting corrosion.

### 2.3.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.2.3 is consistent with the GALL AMP XI.M3.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.3, including BSEP calculation BNP-LR-619, “License Renewal Aging Management Program Description of the Reactor Head Closure Studs Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M3.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.3 and associated bases documents against the GALL AMP XI.M3 for consistency.

From a review of the BSEP document BNP-LR-619, the project team determined that, while BSEP is not committed to Regulatory Guide 1.65, the reactor head closure studs were fabricated, and will be replaced with like-kind studs, as required, in a manner consistent with the recommendations of the regulatory guide (US < 170 ksi). Also, preventive measures consistent with the recommendations of the regulatory guide, such as inspections (UT, MT/PT, etc.) and periodic lubrication with a corrosion inhibitor, are performed. The BSEP studs are non-plated, phosphate coated A-540, B23/B24 material. Following each refueling outage the studs are lubricated by DAG-156 (50% 2-Propanol, 5% Graphite) or equivalent (Fel-Pro N5000; 25%

graphite, 20% nickel) to inhibit corrosion.

The basis document also states that the ASME Section XI, Subsections IWB, IWC and IWD, Inservice Inspection (ISI) Program (described in BSEP calculation BNP-LR-606) 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 (see the Reactor Pressure Vessel ASME Section XI pressure test in accordance with Subsection IWB, Category B-P) required by the ASME Section XI, ISI Program.

The project team reviewed those portions of the BSEP AMP B.2.3, “Reactor Head Closure Studs Program," which the applicant claims is consistent with GALL AMP XI.M3, “Reactor Head Closure Studs ,” and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.3.3 Exceptions to the GALL Report

None

2.3.4 Enhancements

None

2.3.5 Operating Experience

The applicant states, in the BSEP LRA, 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 states in the BSEP LRA 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.

The project team asked the applicant to confirm that: the reactor pressure vessel studs are inspected every 10 years per Section XI ISI requirements; the next series of inspections will be performed in 2007 and 2008; and, all previous inspections have been satisfactory. In its letter dated March 14, 2005 (ML050810493), the applicant confirmed that the above information is accurate.

On the basis of its review of the above operating experience and on discussions with the

applicant's technical staff, the project team concludes that BSEP AMP B.2.3 will adequately manage the aging effects that are identified in the BSEP LRA for which this AMP is credited.

2.3.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the reactor head closure studs program in the BSEP LRA, Appendix A, Section A.1.1.3, which states that the reactor head closure studs program is credited for aging management of the reactor head closure studs and stud components by means of inservice inspection. 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. The reactor head closure studs program is consistent with the corresponding program described in the GALL Report.

The UFSAR Supplement specifies that this AMP is credited for aging management of reactor head closure studs and stud components by means of inservice inspection. The project team noted that the UFSAR supplement does not specify that the BSEP reactor head closure studs program be consistent with the preventive measures recommended by Regulatory Guide 1.65 (as stated in BSEP LRA Appendix B, Section B.2.3, under "Program Description"). In response, the applicant stated that the content and level of detail outlined in BSEP LRA Section A.1.1.3 for the reactor head closure studs program is consistent with the guidance provided in SRP Table 3.1-2 "FSAR Supplement for Aging Management of Reactor Vessel, Internals, and Reactor Coolant System." The UFSAR discussion notes that the BSEP program is consistent with the GALL Report. Therefore, there is no need to discuss the details of Regulatory Guide 1.65. Also, more detail is presented in Appendix B of the LRA than in the summary level of detail presented in Appendix A. The project team concurred with the applicant’s response since it is not required to include program content details in the UFSAR.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.3, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.3.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.4 BWR STRESS CORROSION CRACKING PROGRAM (BSEP AMP B.2.4)

In BSEP LRA, Appendix B, Section B.2.4, the applicant states that BSEP AMP B.2.4, “BWR Stress Corrosion Cracking Program," is an existing plant program that is consistent with GALL AMP XI.M7, “BWR Stress Corrosion Cracking."

2.4.1 Program Description

The applicant states, in the BSEP LRA, that this program manages intergranular stress corrosion cracking (IGSCC) in reactor coolant pressure boundary components made of stainless steel. The program includes:

> Preventive measures to mitigate stress corrosion cracking (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 stress corrosion cracking and intergranular stress corrosion cracking. Preventive methodologies include piping replacement with IGSCC resistant stainless steel. Preventive measures have included heat sink welding, induction heating, and mechanical stress improvement. The BSEP water chemistry program controls water chemistry within parameters that prevent, minimize, and mitigate intergranular stress corrosion cracking.
>
> 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: (i) NUREG-0313; (ii) BWRVIP-75,and, (iii) GL 88-01 and its Supplement 1.

2.4.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.2.4 is consistent with the GALL AMP XI.M7.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.4, including the bases document (BSEP calculation BNP-LR-654, "License Renewal Aging Management Program Description of the BWR Stress Corrosion Cracking Program"), implementing procedures, condition reports, and program procedures, which provide an assessment of the AMP's consistency with GALL AMP XI.M7.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.4 and associated bases documents against the GALL AMP XI.M7 for consistency.

During the audit and review the project team requested additional information on the preventive measures taken to manage IGSCC at BSEP. In its letter dated March 14, 2005 (ML050810493), the applicant provided the following information.

> The preventive measures for IGSCC are two fold. First is the implementation of a Water Chemistry Program that controls the aggressive environment (coolant with high levels of dissolved oxygen or aggressive contaminants, such as sulfates or chlorides) that can foster IGSCC in susceptible materials with significant tensile stress. The BSEP Water Chemistry Program is provided in the License Renewal Application in Section B.2.2 and

is evaluated separately. Second is the replacement of susceptible materials with resistant materials and/or the use of special processes that reduce tensile stresses. The following discusses some of the major BSEP systems that had been subjected to either replacement or special processes:

*Reactor Coolant Recirculation System (RCR)* - The material in the RCR system can be characterized as follows:

- Non-resistant to IGSCC - This includes the 22" and 28" feeder lines. The material used is Type 304 stainless steel. Selected welds in these lines have been weld overlayed and/or stress improved by the mechanical stress improvement process (MSIP) or the induction heating stress improvement process (IHSI).
- Resistant to IGSCC - This includes the 12" riser piping and the 4" bypass lines. This piping was replaced with Type 316 NG (nuclear grade) stainless steel. This material is resistant to IGSCC (Category A) per Generic Letter 88-01.

*Reactor Water Cleanup System (RWCU)*

- The Class 1 portion of the suction segment of the RWCU System is made from Type 316L © and N content is equivalent to Type 316NG) stainless steel which is considered to be not susceptible to IGSCC.
- The Class 1 segment of the RWCU discharge line consists of carbon steel and stainless steel. The carbon steel is not susceptible to IGSCC. The Type 304 stainless steel piping in line 14-4-902 of both units was replaced with Type 316L with controlled Nitrogen. This Type 316 MOD is equivalent to Type 316NG and is not considered susceptible.

*Core Sray System (CS)*

- Stainless steel portions of the CS piping, from the drywell manual isolation valves to the reactor nozzle safe-end have been replaced with carbon steel. This design provides material compatibility and replacement with material not subject to stress corrosion cracking in the BWR coolant environment.
- Unit 1: The nozzle is A508 Class 2. The original inconel cladding was removed and replaced with Type 309L stainless steel weld metal. The safe end is constructed of Type 316NG stainless steel.
- Unit 2: The nozzle is A508 Class 2. The cladding is a combination of Inconel 182 and stainless steel. The safe end is constructed of Inconel Alloy 600.
- Unit 1 and Unit 2: The thermal sleeves are constructed of Type 316 stainless steel.

Weld material used in major systems managed by this program at BSEP can be characterized as follows:

- For the Reactor Vessel and Internals System, the Alloy 182 weld butter on the RPV Nozzle N8A/B nozzle to safe-end weld is considered to be susceptible to IGSCC.
- For the Reactor Coolant Recirculation System, the Inconel buttering is called-out on the as-built drawings for the N1 nozzle. It is assumed that Alloy 182 weld butter was used and it is considered to be susceptible to IGSCC.
- For the Reactor Water Cleanup system, one weld in the RWCU discharge line of each unit is listed as IGSCC Category D and is therefore considered to be susceptible to IGSCC.
- For the Residual Heat Removal System, the dissimilar metal weld to the RCR System (Type 304 stainless steel) for each loop is considered to be

susceptible to IGSCC.

- For the Core Spray System, the Unit 2 safe-end weld is Alloy 600. Theno zzle to safe -end weld received an IHSI treatment. The two safe-end welds per loop are Categories C and D and are therefore considered to be susceptible to IGSCC.

During the audit and review the project team reviewed the applicant's response and determined that it is acceptable on the basis that the preventive measures taken are consistent with the guidance provided in the GALL Report, and they provide reasonable assurance that IGSCC will be managed.

The project team 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 BWRVIP-29, which references the 1993 version of EPRI TR-103515, "BWR Water Chemistry Guidelines." However, the program description for BSEP AMP B.2.4 states that the BSEP 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 project team's evaluation of an exception to the BSEP water chemistry program, which is discussed in Section 2.2.3 of this audit report.

The project team reviewed those portions of the BSEP AMP B.2.4, "BWR Stress Corrosion Cracking Program," which the applicant claims is consistent with GALL AMP XI.M7, "BWR Stress Corrosion Cracking," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.4.3 Exceptions to the GALL Report

None

2.4.4 Enhancements

None

2.4.5 Operating Experience

The applicant states, in the BSEP LRA, 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 NRC 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 project team 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.

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 project team concludes that the applicant's BSEP AMP B.2.4 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

### 2.4.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the BWR stress corrosion cracking program in the BSEP LRA, Appendix A, Section A.1.1.4, which states that the BWR stress corrosion cracking program manages stress corrosion cracking (SCC) including intergranular SCC (IGSCC). The BWR stress corrosion cracking program is consistent with NUREG-0313, BWRVIP-75, and NRC Generic Letter 88-01,and its Supplement 1. The program includes component replacement and preventive measures to mitigate SCC and inspections to monitor SCC and its effects. Replacement methodologies include piping replacement with SCC-resistant stainless steel. Preventive measures include heat sink welding, induction heating, mechanical stress improvement, and water chemistry control in accordance with industry recognized guidelines. The BWR stress corrosion cracking program is consistent with the corresponding program described in the GALL Report.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.4, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

### 2.4.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.5 FLOW-ACCELERATED CORROSION PROGRAM (BSEP AMP B.2.5)

In BSEP LRA, Appendix B, Section B.2.5 , the applicant states that BSEP AMP B.2.5, Flow-Accelerated Corrosion Program," is an existing plant program that will be consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion," with an exception and an enhancement.

### 2.5.1 Program Description

The applicant states, in the BSEP LRA, that the flow-accelerated corrosion (FAC) program provides for prediction, inspection, and monitoring of piping and fittings for a loss of material aging effect due to flow-accelerated corrosion 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-2002L-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 BSEP FAC program manages loss of material in carbon steel piping and fittings.

2.5.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.5 will be consistent with GALL AMP XI.M17, with an exception and an enhancement.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.5, including Nuclear Generation Group, BNP-LR-603, “License Renewal Aging Management Program Description of the Flow-Accelerated Corrosion (FAC) Program,” Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M17.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.5 and associated bases documents against the GALL AMP XI.M17 for consistency.

The project team reviewed those portions of the BSEP AMP B.2.5, “Flow-Accelerated Corrosion Program," which the applicant claims is consistent with GALL AMP XI.M17, “Flow-Accelerated Corrosion," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.5.3 Exceptions to the GALL Report

In the BSEP LRA, the applicant states the following exceptions to the program elements listed for GALL AMP XI.M17 in the GALL Report.

[Scope of Program] The GALL Report identifies the following recommendations for the scope of 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 BSEP FAC susceptibility analyses allow for the exclusion of components operating with superheat or with a steam quality exceeding 99.5%

from further susceptibility evaluation. Typical BWR steam qualities are in excess of 99.5% but some moisture is present.

BSEP FAC susceptibility analyses predate issuance of NSAC-2002L-R2. Experience with FAC modeling has shown that piping with high steam quality (>99.5%) 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.

BSEP calculation EGR-NGGC-2020 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 calculation EGR-NGGC-0202, 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 project team reviewed and 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 project team reviewed and determined that excluding piping, which may contain moisture, from the CHECWORKS model is standard industry practice. Therefore, the project team 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 and would be less likely to be selected for inspections.

On the basis of its review of the above exception, and on discussions with the applicant's technical staff, the project team concluded that the exception stated by the applicant for BSEP AMP B.2.5 to the program elements for GALL AMP XI.M17 are acceptable.

2.5.4 Enhancements

The applicant states, in the BSEP LRA, that the enhancement in meeting the GALL Report element is as follows

[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 BSEP FAC susceptibility analyses to include additional components potentially susceptible to FAC.

In the BSEP FAC Program Implementation Plan, the applicant describes the process for identifying components, which are 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 plans to use the systems elimination calculation to identify these additional components.

The project team 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 above enhancement, and on discussions with the applicant's technical staff, the project team concluded that the enhancement stated by the applicant for BSEP AMP B.2.5 to the program elements for GALL AMP XI.M17 is acceptable.

2.5.5 Operating Experience

The applicant states, in the BSEP LRA, 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 BSEP HPCI and 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 NRC has audited industry programs based on this EPRI methodology at several plants and has determined that these activities can provide a good prediction of the onset of FAC so that timely corrective actions can be undertaken.

In BSEP calculation BNP-LR-6503, the applicant states that the current BSEP FAC program is an outgrowth of the applicant's response to Generic Letter (GL) 89-08, "Errosion/Corrosion-Induced Pipe Wall Thinning." Since its inception, this program has evolved based on industry best practices, self-assessment and NRC inspections. BSEP had previously observed significant but localized erosion on the internal surfaces of several carbon steel valve bodies. The affected safety-related 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 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 of calculation BNP-LR-603, the project team reviewed and 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 project team reviewed and determined that the FAC program has been effective in reducing the number of through wall leaks.

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 project team concludes that the applicant's BSEP AMP B.2.5 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

### 2.5.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the flow-accelerated corrosion program in the BSEP LRA, Appendix A, Section A.1.1.5, which states that prior to the period of extended operation, the BSEP FAC susceptibility analyses will be updated to include additional components potentially susceptible to FAC.

The project team reviewed the UFSAR supplement, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

### 2.5.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team has reviewed the enhancement and determined that the implementation of the enhancement prior to the period of extended operation would result in the existing aging management program being consistent with the GALL program to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.6 BOLTING INTEGRITY PROGRAM (BSEP AMP B.2.6)

In BSEP LRA, Appendix B, Section B.2.6 , the applicant states that BSEP AMP B.2.6, "Bolting Integrity Program," is an existing plant program that will be consistent with GALL AMP XI.M18, "Bolting Integrity," with exception and an enhancement.

### 2.6.1 Program Description

The applicant states, in the BSEP LRA, that this program addresses aging management requirements for bolting on mechanical components within the scope of license renewal. The BSEP 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 the 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.

### 2.6.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.6 will be consistent with GALL AMP XI.M18, with exception and an enhancement.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.6, including BSEP calculation BNP-LR-625, “License Renewal Aging Management Program Description of the Bolting Integrity Program,” which provides an assessment of the AMP's consistency with GALL AMP XI.M18. The project team also reviewed implementing procedures, condition reports, and program procedures, such as BSEP maintenance procedure 0MMM-017, “Maintenance Methods and Guidelines for Torquing,” Revision 23.

The project team reviewed those portions of the BSEP AMP B.2.6, “Bolting Integrity Program," which the applicant claims is consistent with GALL AMP XI.M18, “Bolting Integrity," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.6.3 Exceptions to the GALL Report

In the BSEP LRA, the applicant states the following exceptions to the program elements listed for AMP XI.M18 in the GALL Report.

Exception 1

[Scope of Program] The GALL Report identifies the following recommendations for the scope of 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 recommendations for the parameters monitored/Inspected 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 ≥ 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 recommendations for the detection of aging effects 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 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 (NSSS) supports. Structural bolting is discussed herein only in response to specific issues raised by NUREG-1801 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 recommendations for the monitoring and trending 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 project team reviewed the above exceptions and considered them to represent a major inconsistency between BSEP AMP B.2.6 and GALL AMP XI.M18. The project team requested that the applicant provide additional information to clarify the overall bolting integrity program currently in effect at BSEP, including identification of the program used 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:

> 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 its 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 calculation BNP-LR-625, Table 6.2-1.

The project team reviewed BSEP calculation BNP-LR-625, Table 6.2-1, and determined that it provides information and bases regarding specific activities crediting other AMPs. Based on a review of the applicants response and the documentation noted, the project team reviewed and determined that the applicant appropriately manages aging of structural bolting, including bolting for NSSS component supports, by implementing the BSEP AMP B.2.20, ASME Section XI, Subsection IWF Program, and BSEP AMP B.2.23, 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 BSEP AMP B.2.1, ASME Section XI,

Subsections IWB, IWC and IWD Program and BSEP AMP B.2.29, Systems Monitoring Program.

With regard to the applicant's exception to the program element for monitoring and trending, the project team asked the applicant to clarify the activities performed at BSEP to monitor leakage for pressure retaining bolting outside the ASME Section XI boundaries. In its response, the applicant stated that the BSEP 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 project team reviewed the applicant's response and requested information on the leakage inspection frequency used at BSEP 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.

Based on the applicant's response the project team concluded that the applicant appropriately manages the pressure retaining bolting outside the ASME Section XI boundaries by this AMP in combination with the BSEP 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.

Subsequent to the AMP audit, as part of its audit of the AMRs for the engineered safety features systems in Section 3.2 of the BSEP LRA, the project team asked for clarification on the bolting integrity program as it relates to pressure retaining bolting. The applicant committed to revising the BSEP 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. This is further discussed in Section 3.2.1.1 of this audit report.

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 project team concluded that the exceptions stated by the applicant for BSEP AMP B.2.6 to the program elements for AMP GALL XI.M18 are acceptable.

2.6.4 Enhancements

In the BSEP LRA, the applicant states the following enhancement to program elements in the GALL Report:

[Preventive Actions] The GALL Report recommends the following 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 project team 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 project team concluded that the enhancement stated by the applicant for BSEP AMP B.2.6 to the program elements for GALL AMP XI.M18 is acceptable.

2.6.5 Operating Experience

In the BSEP LRA, the applicant states that this program is based on industry guidance that considers operating experience (OE). BSEP OE includes verification of fastener material properties in accordance with NRC Bulletin 87-02, “Fastener Testing to Determine Conformance With Applicable Material Specifications,” issued 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 states that the OE 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.

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 project team concludes that the applicant’s BSEP AMP B.2.6 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.6.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the bolting integrity program in the BSEP LRA, Appendix A, Section A.1.1.6, which provides a description of the program and states that prior to the period of extended operation, a precautionary note will be added to plant bolting guidelines to limit the sulfur content of compounds used on bolted connections.

The project team reviewed the UFSAR Supplement for BSEP AMP B.2.6, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as

required by 10 CFR 54.21(d).

### 2.6.7 Conclusion

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

## 2.7 OPEN-CYCLE COOLING WATER SYSTEM PROGRAM (BSEP AMP B.2.7)

In BSEP LRA, Appendix B, Section B.2.7 , the applicant states that BSEP AMP B.2.7, "Open-Cycle Cooling Water System Program," is an existing plant program that will be consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System," with enhancements.

### 2.7.1 Program Description

The applicant states, in the BSEP LRA, that this program relies on implementation of the recommendations of the NRC 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) 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.

The OCCW program addresses portions of the service water (SW) systems of BSEP Unit 1 and Unit 2. The program scope includes safety related portions of both the nuclear and conventional SW headers. The OCCW portion of the residual heat removal service water (RHR-SW), diesel generator heat exchangers and associated service water piping/components, and other safety related heat loads cooled by the SW system are also included in the scope of the program. Additionally, the program is credited with aging management of limited non-safety related piping and components included in 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.

### 2.7.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.7 will be consistent with GALL AMP XI.M20, with enhancements. .

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.7, including BSEP

calculation BNP-LR-602, “License Renewal Aging Management Program Description of the Open Cycle Cooling Water System Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M20.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.7 and associated bases documents against the GALL AMP XI.M20 for consistency.

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 project team reviewed those portions of the BSEP AMP B.2.7, “Open-Cycle Cooling Water System Program," which the applicant claims is consistent with GALL AMP XI.M20, “Open-Cycle Cooling Water System," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.7.3 Exceptions to the GALL Report

None

2.7.4 Enhancements

In the BSEP LRA, the applicant states the following enhancements to program elements 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 BSEP open-cycle cooling water system program will include portions of the SW system credited in the aging management review, 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 BSEP OCCW program was originally developed in response to NRC Generic Letter 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 safety related 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 and 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 states that this enhancement will be integrated into BSEP engineering procedure 0ENP-2704 which governs the BSEP Generic Letter 89-13 program.

During the audit and review the project team asked the applicant to provide a more detailed description of components to be included by this enhancement and to explain why the reactor building HVAC system is not included in the scope since this AMP is credited in BSEP LRA Table 3.3.2-22. The applicant stated that the expansion of inspection scope over that prescribe by GL 89-13 is generally that part of the system beyond safety-related 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 service water system. Note that the latter is safety-related, but not specifically addressed in the GL 89-13 program. These portions of the system can most readily be identified by inspection of the license renewal flow diagrams for the service water system (see D-2537-LR, 2041-LR, 2274-LR, 25037-LR, 20041-LR, all sheets).

The applicant further stated that, relative to the OCCW program description in Appendix B not specifically including the reactor building HVAC System, the program descriptions in BSEP LRA Appendices A and B are general descriptions and 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 is provided in the Section 3 tables, and Table 3.3.2-22 correctly represents coils in the ECCS Pump Room coolers as managed by the OCCW AMP.

The project team reviewed the applicant’s response and determined that this enhancement is acceptable on the basis that it provides assurance that the effects of aging to piping and components that are within the scope of license renewal under 10 CFR 54.4(a)(2), 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 states that its operating experience review has identified erosion of OCCW system piping/components associated with throttling. Specifically, erosion has been noted in non-safety related piping adjacent to the throttle valves where service water exits the reactor buildings, and at flow orifice plates on the line from the RHR service water booster pump motor coolers. Both of these locations are in non safety-related piping, which was outside the scope of the BSEP 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. The applicant plans to identify inspection locations before each outage based on operating experience, a 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.

The project team reviewed and 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.

In BNP-LR-602, the licensee states that piping in the scope of this aging management program is regularly inspected for evidence of biofouling, silting and corrosion. Service water pumps, strainers and heat exchangers are periodically disassembled and/or flushed, as appropriate. To achieve consistency with this GALL element, the applicant states that, prior to the extended period of operation: the RHR heat exchangers will be subject to eddy current testing; a representative sampling of the service water pump casings will be inspected; and, service water pump lube oil cooler flow and heat transfer effectiveness will be proceduralized in the OCCW 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.

The project team asked the applicant to clarify whether the RHR coolers are going to be replaced, or if the procedures will be enhanced to include inspection and replacement criteria. In its response, the applicant stated that operating experience shows that, with the current design, the RHR seal coolers require replacement every 2 years to address corrosion concerns. 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 4 years even if the corrosion concerns were addressed. Therefore, the procedural requirement will be to replace the coolers every 2 years, noting that this can be extended to 4 years on the basis of implementing the aforementioned plant modifications

The project team 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 project team reviewed and determined that the enhancements described above provide 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 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 BSEP LRA, the applicant states that 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. 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.

The project team noted that the BSEP 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 BSEP LRA credits regular inspections and cleaning in lieu of testing, the project team noted that program implementing procedure OENP-2704, Rev. 8, specifies that testing of the capabilities of the RHR and emergency diesel

generator jacket water heat exchangers would be performed and documented. The project team asked the applicant to clarify the apparent inconsistency between the implementing procedure and the BSEP open-cycle cooling water program, as described in its BSEP LRA.

In its letter dated March 31, 2005 (ML051330020), the applicant stated that the BSEP open-cycle cooling water 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.

The project team reviewed and determined that this new commitment to conduct performance testing, together with the applicant's commitment to trend eddy current test results, provides reasonable assurance that heat exchanger performance will be adequately managed for the extended period of operation.

On the basis of its review of the above enhancements, the applicant's responses to audit questions, and discussions with the applicant's technical staff, the project team concluded that the enhancements stated by the applicant for BSEP AMP B.2.7 to the program elements for GALL AMP XI.M20, as modified by the commitment discussed above, are acceptable.

2.7.5 Operating Experience

The applicant states, in the BSEP LRA, that a review of recent system operating history shows that the open-cycle cooling water 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 states 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 open-cycle cooling water system program.

During the audit and review the project team asked the applicant to provide a more detailed description of the process to identify locations where throttling of changes in flow direction might result in erosion of copper nickel piping and the planned inspection procedure revisions. Also, the applicant was asked to describe the current status and scope of this effort. 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 BSEP Generic Letter 89-13 program. This requirement and other elements of the license renewal open-cycle cooling water program will be integrated into that program document.

The applicant also stated that, regarding the adequacy of the "current program", the license renewal open-cycle cooling water system program and the BSEP Generic Letter 89-13 program are related, but different, programs. The BSEP 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 open-cycle cooling water system program is based on a GALL Report program description, which relies on GL 89-13, but has a broader scope that includes nonsafety-related components meeting the requirements of 10CFR54.4(a)(2). For example, the Generic Letter

89-13 program extends to the safety related boundary on the discharge piping exiting the reactor building. The open-cycle cooling water AMP 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 and to its exit at the discharge weir. The enhancements described in the BSEP LRA pertain to the license renewal open-cycle cooling water AMP, not necessarily to the BSEP Generic Letter 89-13 Program.

The applicant also stated that, generally, enhancements to the license renewal open-cycle cooling water system program either: (1) involve components that are outside the GL 89-13 program; or, (2) are activities that already are being done that are being formalized in a program document to meet specific implementation/documentation requirements prescribed by the OCCW AMP. While consideration may be given to including these items in the BSEP GL 89-13 program, this does not infer the current program is 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, this has been noted in piping downstream of the throttle valves where service water exits the reactor buildings, and at flow orifice plates on the line from the RHR service water booster pump motor coolers. Both these locations are in non-safety related piping outside the scope of the current BSEP GL 89-13 program. Inspection requirements for both locations will be formalized in the integrated program document to satisfy license renewal requirements.

The project team reviewed the applicant's response and determined that it 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.

In BSEP calculation BNP-LR-01, "Operating Experience (OE) Review of Materials and Programs for License Renewal," the applicant states that plant specific operating experience has been captured by a review of the action tracking (AR) database and the maintenance rule (MR) database.

Implementing procedures selected for review by the project team includes BSEP Procedures EGR-NGGC-0504, "Mechanical System Aging Management Review for License Renewal" and CAP-NGGC-0202, "Operating Experience Program." Procedure EGR-NGGC-0504 stipulates that relevant site and industry operating experience (OE) be considered in the determination of anticipated aging effects and the effectiveness of required programs.

Procedure CAP-NGGC-0202 directs the review of operating experience and requires that operating experience be screened and evaluated for site applicability. Relevant results of this review are cited in the BSEP LRA. With regard to the OCCW system program, these include corrective action program Action Reports (AR): AR 106130, which documents the resolution of an INPO/WANO concern with testing of service water cooled heat exchangers; AR 106070, that addresses the enhancement of programmatic controls associated with the open cycle cooling water program; and, AR 106133, that pertains to incorporating additional information in the system notebook to improve performance evaluation and trending

In addition to the above reviews, equipment within the open-cycle cooling water program is subject to ongoing reviews and assessments. The process for identifying, documenting, tracking, investigating, correcting, and trending conditions adverse to quality is described in BSEP procedure CAP-NGGC-0200, "Corrective Action Program." During the period of November 3 -7 and November 17-21, 2003, the adequacy of this program was reviewed by a team of NRC inspectors. As documented in their report (ref.: NRC Inspection Report Nos.: 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.

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 project team concludes that the applicant's BSEP AMP B.2.7 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.7.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the open-cycle cooling water system program in the BSEP LRA, Appendix A, Section A.1.1.7, which states:

> The 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 require that: (1) the program scope includes portions of the SW system credited in the aging management review, including non-safety related 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 open-cycle cooling water system program will be consistent with the corresponding program described in the GALL Report.

In its letter dated March 31, 2005 (ML050970259) the applicant identified a change to the enhancements provided in the second paragraph of the description of the OCCW Program in BSEP LRA, Appendix A, Section A.1.1.7. The change would incorporate new enhancement number six to read:

> Performance testing of the RHR and Emergency Diesel Generator Jacket Water heat exchangers will be performed to verify heat transfer capability.

The project team reviewed the revised UFSAR supplement for BSEP AMP B.2.7, found that, it is consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.7.7 Conclusion

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

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

## 2.8 CLOSED-CYCLE COOLING WATER SYSTEM PROGRAM (BSEP AMP B.2.8)

In BSEP LRA, Appendix B, Section B.2.8, the applicant states that BSEP AMP B.2.8, "Closed-Cycle Cooling Water System Program," is an existing plant program that will be consistent with GALL AMP XI.M21, "Closed-Cycle Cooling Water System," with enhancements.

### 2.8.1 Program Description

The applicant states, in the BSEP LRA, that the closed-cycle cooling water system program addresses aging management of components in the reactor building closed cooling water (RBCCW) and diesel generator (DG) jacket water cooling systems. These systems are closed cooling loops with controlled chemistry, consistent with the NUREG-1801 description of a closed-cycle cooling water 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 closed-cycle cooling water (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.

### 2.8.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.8 will be consistent with GALL AMP XI.M21, with enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.8, including BSEP calculation BNP-LR-627, "License Renewal Aging Management Program Description of the Closed Cycle Cooling Water Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M21

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.8 and associated bases documents against the GALL AMP XI.M21 for consistency.

In addition, the project team reviewed a selected sample of BSEP implementing procedures including 0AI-81 "Water Chemistry Guidelines," which incorporates the guidelines of EPRI TR-107396 and provides chemistry control parameters and corrective actions to be performed if

a specific parameter is exceeded. Attachments 15 and 16 of 0AI-81 provide water quality control specifications for the reactor building closed cooling water and diesel generator cooling water systems, respectively. Chemistry specification control parameters cited in BSEP Procedure 0AI-81 include the achievable value that can be maintained by the application of good operating practices and action levels for corrective actions.

In the BSEP LRA, the applicant states that BSEP AMP B.2.8 addresses aging management of components in the reactor building closed cooling water (RBCCW) and diesel generator (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 closed-cycle cooling water system in the GALL Report. These systems use demineralized water and a chemical corrosion inhibitor.

The project team reviewed those portions of the BSEP AMP B.2.8, “Closed-Cycle Cooling Water System Program," which the applicant claims is consistent with GALL AMP XI.M21, “Closed-Cycle Cooling Water System," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.8.3 Exceptions to the GALL Report

None

2.8.4 Enhancements

In the BSEP LRA, the applicant states 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 of cooling fins and surfaces of the DG combustion air intercoolers for corrosion or fouling.

The applicant states, in the BSEP LRA, that testing and inspections of the diesel generator jacket water cooling water heat exchangers are performed regularly, as prescribed by the open-cycle cooling water system program. The diesel generator combustion air intercoolers are regularly tested as a part of the diesel generators. Testing of the non-safety related 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 diesel generator 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 diesel generator jacket water cooling water. The applicant commits to enhancing current PM activities to include external inspections of combustion air intercoolers.

The efficacy of closed-cooling water 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 (OE) regarding corrosion in system components. In BSEP calculation BNP-LR-627, the applicant states that its operating experience review found no incidence of age related degradation associated with the diesel generator jacket water system.

During the audit and review the project team reviewed and 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

> Detection of Aging Effects: 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: Preventive Maintenance activities include inspections of DG combustion air intercoolers and heat exchangers. These activities will ensure that applicable potential aging effects are identified.

The BSEP diesel generators and diesel generator jacket water cooling system are not normally in service but are closely monitored during regular testing for trends indicative of degraded performance. The applicant states, in the BSEP LRA, that the diesel generators are tested regularly as required by plant technical specifications. The diesel generator jacket water cooling system is regularly tested as part of the diesel generator and inspected regularly under the open cycle cooling water system and preventive maintenance (PM) programs.

The diesel generator is subjected to an array of PM activities that include disassembly and inspection of heat exchangers, and other critical components exposed to the diesel generator jacket water cooling water. The diesel generator combustion air intercoolers are regularly tested as a part of the diesel generators. In the BSEP LRA, the applicant commits to enhancing PM activities to include external inspections of combustion air intercoolers.

In BSEP calculation BNP-LR-627, the applicant states that the closed-cycle cooling water 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 project team reviewed and 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, and on discussions with the applicant's technical staff, the project team concluded that the enhancements stated by the applicant for BSEP AMP B.2.8 to the program elements for GALL AMP XI.M21 are acceptable.

2.8.5 Operating Experience

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

In BSEP calculation BNP-LR-627, the applicant states 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.

The applicant states, in the BSEP LRA, that an operating experience review found no incidence of age related degradation associated with BSEP closed-cycle cooling water systems. RBCCW operating experience at BSEP includes service water related (tubeside) fouling and corrosion or plugging of the RBCCW heat exchanger tubes. Since these components are in scope for spatial interaction only, the shell performs an intended function, and tube degradation does not impact the scope of aging management reviews. Moreover, aging management of raw water components is performed by the open-cycle cooling water system. BSEP operating experience review found no incidence of age related degradation associated with the diesel generator jacket water system.

During the audit and review the project team also reviewed the results of a BSEP self assessment of the closed-cycle cooling water chemistry program. Specifically, the project team selected BSEP Self Assessment Report Number AR 53006. 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, regulatory compliance, and safety. The applicant performed the evaluation during the period of November 4 – 8, 2002, and included the RBCCW and the diesel generator jacket water systems. As documented in BSEP Report AR 53006, an evaluation performed in May 2001 by the Institute of Nuclear Power Operations (INPO), 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 this issue, the applicant completed Adverse Condition Investigation (AR 44704) in July 2001. The project team found that the 2002 self assessment concluded that he BSEP closed cooling water program ensures that chemistry parameters are maintained within specifications.

In BSEP calculation BNP-LR-627, the applicant states that the operating experience review of the BSEP CCCW system program is continually upgraded based on site and industry experience and research.

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 project team concludes that the applicant's BSEP AMP B.2.8 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.8.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the closed-cycle cooling water system program in the BSEP LRA, Appendix A, Section A.1.1.8, which states that the closed-cycle cooling water system program addresses aging management of components in the RBCCW and diesel generator jacket water cooling systems. These systems are closed cooling loops with controlled water chemistry, consistent with the GALL Report description of a closed-cycle cooling water system. Both the reactor building closed cooling water and diesel generator jacket water cooling water systems employ an effective chemistry program augmented by component testing and inspection based on EPRI TR-107396, "Closed Cooling Water Chemistry Guideline," to assure the license renewal intended function(s) are maintained.

Prior to the period of extended operation, program activities will be enhanced to assure that preventive maintenance activities include inspections of DG combustion air intercoolers and heat exchangers.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.8, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.8.7 Conclusion

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

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

2.9 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD HANDLING SYSTEMS PROGRAM (BSEP AMP B.2.9)

In BSEP LRA, Appendix B, Section B.2.9, the applicant states that BSEP AMP B.2.9, "Inspection of Overhead Heavy Load and Light Load Handling Systems Program," is an existing plant program that will be consistent with GALL AMP XI.M23, "Inspection of Overhead Heavy Load

and Light Load (Related to Refueling) Handling Systems," with enhancements.

2.9.1 Program Description

The applicant states, in the BSEP LRA, that the inspection of overhead heavy load and light load handling systems 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.

2.9.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.9 will be consistent with GALL AMP XI.M.23, with enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.9, including BSEP calculation BNP-LR-628, “License Renewal Aging Management Program Description Of the Inspection of Overhead Heavy Load and Light Load Handling Systems Program,” June 21, 2004, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M.23.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.9 and associated bases documents against the GALL AMP XI.M23 for consistency.

On the basis of its audit and discussions with the applicant, the project team reviewed and determined that the inspection of overhead heavy load systems program is implemented through procedures and work order packages. BSEP’s standard procedure EGR-NGGC-0351 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 preventive maintenance procedures, OPM-CRN501 and OPM-CRN502, 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 inspection process requires an evaluation of the extent of degradation such that the component can be classified as “Acceptable,” “Acceptable with Deficiencies,” or “Unacceptable.”

The reactor building bridge cranes and the intake structure gantry crane were designed to the Crane Manufactures Association of America (CMAA) Specification # 70, with a Service Class A1 (standby service). The refuel platforms were designed to a General Electric specification, which established the required safety factors and specified the design code as the American Institute of Steel Construction (AISC).

The applicant assessed the load cycle limits for cranes that are within the scope of license renewal using time-limited aging analyses (TLAAs). The applicant concluded that the analyses of the cranes have been projected to the end of the period of extended operation. The staff will document its evaluation of these TLAAs in the BSEP Safety Evaluation Report, Section 4.7.3.

The project team reviewed those portions of the BSEP AMP B.2.9, “Inspection of Overhead Heavy Load and Light Load Handling Systems Program," which the applicant claims is consistent with GALL AMP XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.9.3 Exceptions to the GALL Report

None

2.9.4 Enhancements

In the BSEP LRA, the applicant states 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: Revise administrative controls to include all cranes within the scope of license renewal, not only the safety-related cranes.

The applicant identified the turbine building bridge crane and the heater bay gantry crane as cranes that it plans to include in the inspection of overhead heavy load and light load handling systems program. The applicant plans to implement procedures and/or work orders to manage the aging of these two cranes prior to the period of extended operation. On the basis of its evaluation of the applicant’s existing program and planned enhancement, the project team reviewed and 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: Revise administrative controls to require maintenance to forward completed inspection reports to the responsible engineer.

The project team reviewed and 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 project team reviewed and 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: 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.

In BNP-LR-628, the applicant states that it plans to revise its Procedure EGR-NGGC-0351 to: include all cranes within the scope of license renewal, rather than just the safety-related 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 maintenance procedure OPM-CRN501, "PM for the Fixed Gantry and Track Cranes," will be revised to include inspection of structural components for corrosion. Maintenance Procedure OPM-CRN502, "Maintenance Instructions for the Steans-Rodger Refueling Platform," will be revised to specifically address corrosion of structural components and cane rail wear.

During the audit and review the project team reviewed and 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 aging management program in the GALL Report. On the basis of its evaluation of the applicant's existing program and planned enhancements, the project team reviewed and determined that there is reasonable assurance that aging effects will be detected.

On the basis of its review of the above enhancement and on discussions with the applicant's technical staff, the project team concluded that the enhancements stated by the applicant for BSEP AMP B.2.9 to the program elements for GALL AMP XI.M23 are acceptable.

2.9.5 Operating Experience

The applicant states, in the BSEP LRA, 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.

In BSEP calculation BNP-LR-628, the applicant identified the following corrective action reports associated with cranes: (1) underside of the intake structure crane end trucks severely corroded, AR 44106; (2) U2 refuel bridge tracks not straight, level, or parallel with respect to each other identified August 23, 2001, AR 46983; (3) documentation of operations inspections of refuel bridge need 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 shaving presently rest on the overhead crane tracks due to wear on tracks, AR 72174.

The project team reviewed the Adverse Condition Investigation Form, Action Request Number 44106, which concerned the June 2001 finding of severe corrosion on the underside of the intake structure crane end trucks. In October 2001, the applicant used ultrasonic tests (UT) 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 in November 2001. Additional inspections by the applicant in August 2004 verified the absence of material degradation. The project team reviewed and determined that the applicant's corrective actions taken in response to identified aging degradation were effective in managing the degradation.

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 project team concludes that the applicant's BSEP AMP B.2.9 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.9.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the inspection of the overhead heavy load and light load handling systems program in the BSEP LRA, Appendix A, Section A.1.1.9, which summarizes the program description and provides the following commitments.

> Administrative controls for the program will be enhanced, prior to the period of extended operation to: (1) include in the program all cranes/platforms 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; (4) require maintenance inspection reports to be forwarded to the responsible engineer; and, (5) include inspection of structural component corrosion and monitoring crane rails for abnormal wear. The enhanced program will be consistent with the corresponding program described in the GALL Report.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.9, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

### 2.9.7 Conclusion

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

## 2.10 FIRE PROTECTION PROGRAM (BSEP AMP B.2.10)

In BSEP LRA, Appendix B, Section 2.10 , the applicant states that BSEP AMP B.2.10, "Fire Protection Program," is an existing plant program that is consistent with GALL AMP XI.M26, "Fire Protection," (as modified by NRC ISG-04), with exceptions.

### 2.10.1 Program Description

The applicant states, in the BSEP LRA, that the fire protection program is credited for aging management of the fire protection components (penetration seals, barrier walls, ceiling and floors, and fire doors, gaseous (Halon/CO2) fire suppression systems, the diesel-driven fire pump fuel oil supply line, and the fire pump diesel engine heat exchanger. The program is implemented through various plant procedures and is proven to adequately manage the aging effects associated with the subject components.

As stated in BSEP UFSAR Section 9.5.1, the fire protection program at BSEP consists of design features, equipment, personnel, and procedures, which combine to provide for a multi-tiered safeguard against a fire, which could impact the health and safety of the public. The objective of the fire protection program is 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.

### 2.10.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.10 is consistent with GALL AMP XI.M26, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.10, including BSEP calculation No. BNP-LR-612, "License Renewal Aging Management Program Description of the Fire Protection Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M26.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.10 and associated bases documents against the GALL AMP XI.M26 for consistency.

In BSEP calculation BNL-LR-612, the applicant states 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 states that based on its review of operating history data and assessment results, the BSEP 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.

The project team reviewed those portions of the BSEP AMP B.2.10, "Fire Protection Program," which the applicant claims is consistent with GALL AMP XI.M26, “Fire Protection,” and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.10.3 Exceptions to the GALL Report

In the BSEP LRA, the applicant states 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% 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%. However, based on plant operating history, the sample provides reasonable assurance the entire population is adequately monitored. Additionally, ISG-04 has modified the GALL recommendation to a sample size of approximately 10%.

In BSEP calculation No. BNP-LR-612, the applicant states that a visual inspection of a statistical sample 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% 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%. The applicant further states 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% as recommended in the GALL Report, the applicant has identified its inspection sample process as an exception to GALL.

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 at BSEP is controlled by Procedure 0AP-033, “Fire Protection Program Manual (FPPM).” In addition to establishing the administrative control requirements of the fire protection program, the project team’s review of this procedure found it to require periodic surveillances of fire protection systems and features and that these surveillances are documented in and implemented through plant procedures.

The project team also reviewed 0PLP-01.2, ““Fire Protection System Operability, Action, and Surveillance Requirements” and implementing procedure 0PT-34.6.7.10 “Fire Barrier Penetration Seals Diesel Generator Building, Rev. 10.”

Operability, action, and surveillance requirements for fire barrier penetrations are established in Section 6.6 of 0PLP-01.2. As described in Section 6.6.3, 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%. 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.

The stated purpose of procedure 0PT-34.6.7.10 “Fire Barrier Penetration Seals Diesel Generator Building,” is 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 safety-related areas are functional. Section 7 of OPT-34.6.7.10 mandates that the inspection scope and frequency be expanded if an unacceptable number of seals are found to be degraded. The project team reviewed and determined that these measures ensure timely detection of increased hardness and shrinkage of penetration seals before there is a loss of component intended function.

In BSEP calculation BNP-LR-612, the applicant states that its sampling method has been determined to be both acceptable for the BSEP configuration and adequate to assure the capability of the penetration seals to preserve the safe shutdown capability of BSEP from fire.

In BSEP calculation BNP-LR-612 and BNP-LR- 011, “Operating Experience (OE) Review of Materials and Programs for License Renewal,” the applicant states that no unpredicted aging unique to the BSEP materials, service conditions or environments has been yet been identified.

During the audit and review the project team 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 (AQL) 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, and has been evaluated, and provides reasonable assurance that the aging of subject components will be managed. In addition, the applicant states that a review of past surveillance results found that failures are individual, isolated problems and not the general failure of any one type of seal. Also, plant operating experience has demonstrated that penetration seal failure has not been prevalent.

The project team 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%, since the applicant states that the sampling selection methodology provides a sample size which may be greater or less than 10%. 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 applicants 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 project team reviewed and 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 BSEP fire protection program does not require visual inspection of each type of penetration seal but rather a statistical sample 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 of BSEP. Based on the sampling process and frequency of inspections, a representative sampling is assured.

In BSEP calculation BNP-LR-612, the applicant states that a visual inspection of a statistical sample 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 AQL of

96% in accordance with ANSI/ASQC Z1.4-1993. On the basis of inspection results, the scope of the inspection is expanded to include additional seals. The applicant further states 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, seal intact, and are structured to verify operability of the penetration seal. 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 project team reviewed implementing procedures 0PLP-01.2, "Fire Protection System Operability, Action, and Surveillance Requirements" and 0PT-34.6.7.10 "Fire Barrier Penetration Seals Diesel Generator Building, Rev. 10." 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.

In BNP-LR-612 and BNP-LR- 011, "Operating Experience (OE) Review of Materials and Programs for License Renewal," the applicant states that no unpredicted aging unique to the BSEP materials, service conditions or environments have been yet been identified. In response to a project team question, the applicant further stated that a review of past surveillance results found that failures are individual, isolated problems, and not the general failure of any one type of seal, and that plant operating experience has demonstrated that penetration seal failure has not been prevalent.

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 project team reviewed and 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: The ISG-04 modified GALL Report program element recommends system functional testing at least once every six months for the halon/carbon dioxide 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 GALL, 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

BSEP 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.

In its letter dated June 17, 2002, the staff received written comments from the Nuclear Energy Institute (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 Interim Staff Guidance (ISG)-04, "Aging Management of Fire Protection Systems for License Renewal." In its cover letter the staff states 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. In ISG-04, the NRC staff states 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/carbondioxide system inspections for changing pressure, valve lineups, and automatic mode of operation.

On the basis of its review and discussions with the applicant, the project team reviewed and 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 recommendations for 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 are performed for the subject components rather than a VT-1 or equivalent inspection. However, the applicable inspection criteria are sufficient to assure detection of aging effects for the components.

The applicant states, in the BSEP LRA, 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 BSEP 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 project team reviewed 0PLP-01.2, "Fire Protection System Operability, Action, and Surveillance Requirements." This procedure outlines the operability, action, and surveillance requirements for fire protection systems at BSEP, including the CO2 and halon systems. 0PLP-01.2 requires that the minimum specified weight of CO2 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 CO2 flooding system headers and nozzles is performed every 18 months. With regard to the halon system, 0PLP-01.2 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 pressure. In BNP-LR-612 the applicant states 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.

The project team asked the applicant to provide additional information on the technical basis for its inspection intervals and the type and nature of visual inspections performed on the halon/carbon dioxide fire suppression system. 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 aging effects requiring management are expected for halon and $CO_2$ system components exposed to these gases. The applicant further states that in accordance with the NFPA requirements, halon and $CO_2$ inspection procedures include periodic visual inspections and functional tests every 18-months to examine for signs of degradation of the fire suppression systems. The project team reviewed and determined that the applicants response is acceptable since aging effects are not expected for the halon and $CO_2$ system.

Section 9.5.1.3.4 of the BSEP UFSAR 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. Fire protection equipment and systems are subject to an inspection and acceptance test in accordance with the NFPA codes, Nuclear Electric Insurance Limited (NEIL) Members Manual, and plant procedures, after installation is complete. After the system is in operation, periodic inspections and tests are conducted as defined by the fire protection program, NEIL Members Manual, and NFPA codes.

Although the inspections and tests are less frequent than those recommended in the GALL Report, the project team reviewed and determined that the current program frequency is sufficient to ensure 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, as discussed in Section 2.10.5 below, the project team reviewed and determined that this exception is acceptable.

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 project team concluded that the exceptions stated by the applicant for BSEP AMP B.2.10 to the program elements for GALL AMP XI.M26 are acceptable.

2.10.4 Enhancements

None

2.10.5 Operating Experience

The applicant states, in the BSEP LRA, that the fire protection 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 states 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 project team's review of BSEP Procedure CAP NGGC-0202, "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 (OE) sources subject to review under this procedure include INPO and WANO OE items (EARs, ENRs, JITs, SENs, SERs, SOERs and SOs), NRC documents (INs, Generic Letters, Notices of Violation, and staff reports), 10 CFR 21 reports, and vendor bulletins, as well as corporate internal operating experience information from Progress Energy nuclear sites. This information is maintained in databases suitable for keyword searches for license renewal applicability. 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 applicant states that the AR, MR and operating experience databases have characteristics that make them reliable and relevant to aging concerns, and their information is suitable for keyword searches for license renewal applicability.

In BSEP calculation BNP-LR-612, the applicant states that the operating history and assessment results for the fire protection program show that the fire protection program it is an effective means of ensuring the preservation from fire of the safe shutdown capability of BSEP. In addition, the applicant states that the fire protection program is continually upgraded and improved as prompted by industry experience, research and routine program performance.

In BSEP calculation BNP-LR-612, the applicant states that the BSEP operating history was specifically reviewed with respect to the industry issues presented in GALL AMP XI.M26 Program Element 10. The results of this review are as follows:

- IN 88-56 addresses concerns about voids, gaps, splits, etc. in silicone penetration seals. The operating history indicates no significant problems of this type
- IN 94-28 and IN 97-70 address 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
- 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 late 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 project team concludes that the applicant's BSEP AMP B.2.10 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.10.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the fire protection program in the BSEP LRA, Appendix A, Section A.1.1.10, which states that the Fire Protection Program includes a fire barrier inspection program and a diesel-driven fire pump inspection program. The fire barrier inspection program requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire rated doors to ensure that their operability is maintained. The diesel driven fire pump inspection program requires that the pump be periodically tested to ensure that the fuel supply line and the fire pump diesel engine heat exchanger can perform their intended functions. The AMP also includes periodic inspection and test of halon/carbon dioxide fire suppression system.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.10, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.10.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.11 FIRE WATER SYSTEM PROGRAM (BSEP AMP B.2.11)

In BSEP LRA, Appendix B, Section B.2.11, the applicant states that BSEP AMP B.2.11, "Fire Water System Program," is an existing plant program that will be consistent with GALL AMP XI.M27, "Fire Water System," (as amended by NRC ISG-04), with enhancements.

### 2.11.1 Program Description

The applicant states, in the BSEP LRA, that the fire water system 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.

### 2.11.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.11 will be consistent with GALL AMP XI.M27, with enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.11, including BSEP calculation No. BNP-LR-611, “License Renewal Aging Management Program Description of the Fire Water System Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M27.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.11 and associated bases documents against the GALL AMP XI.M27 for consistency.

The applicant states, in BSEP calculation BNP-LR-611 that periodic flow testing is performed in accordance with procedures 0PT-34.7.1.0, “Fire Suppression Water System Flow Test,” and 0PT-34.7.2.1, “Hose Station Flow.” However, the system configuration does not support full flow testing through all affected piping and components. As an alternative, the plant maintenance process, as described in BSEP procedures CAP-NGGC-0200, “Corrective Action Program;” 0MMM-001, “Maintenance: Conduct Of Operations;” and ADM-NGGC-0104, “Work Management Process,” includes visual inspection of the internal surfaces of the fire protection piping upon each entry into the system for routine or corrective maintenance. In BSEP calculation BNP-LR-611, the applicant further states that these inspections include provisions for determining: (1) wall thickness to ensure against catastrophic failure; and (2) the inner diameter of the piping as it applies to the flow requirements of the fire protection system. In addition, the applicant states 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.

The project team reviewed those portions of the BSEP AMP B.2.11, “Fire Water System Program," which the applicant claims is consistent with GALL AMP XI.M27, “Fire Water System," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.11.3 Exceptions to the GALL Report

None

2.11.4 Enhancements

In the BSEP LRA, the applicant states 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 recommendations 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 BSEP 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 project team reviewed BSEP document OAP-033, "Fire Protection Program Manual." The purpose of this document is to identify and describe the organizational responsibilities and authorities, core areas, key processes, process elements, supporting procedures, and interfaces which collectively form the BSEP fire protection program. Section 1.3 of this document requires that evaluations and reviews, operating requirements/limitations, surveillance requirements, and compensatory measures for fire protection features at BNP 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 project team reviewed and determined that this enhancement is acceptable, as it provides assurance 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.

In its letter dated December 3, 2002, the staff issued Interim Staff guidance (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 BSEP LRA, the applicant stated that a majority of the BSEP 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 project team reviewed and determined that the above enhancement is acceptable since it is consistent with the guidance provided in ISG-04.

2.11.5 Operating Experience

The applicant states, in the BSEP LRA, 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.

During the audit and review the project team reviewed procedure CAP NGGC-0202, "Operating Experience Program." This procedure directs the review of operating experience and requires that operating experience be screened and evaluated for site applicability. Operating Experience (OE) sources subject to review under this procedure include INPO and WANO OE items (EARs, ENRs, JITs, SENs, SERs, SOERs and SOs), NRC documents (INs, Generic Letters, 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. This information is maintained in databases suitable for keyword searches for license renewal applicability. 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 AR, 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.

In BSEP calculation BNP-LR-611, the applicant states 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 project team concludes that the applicant's BSEP AMP B.2.11 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.11.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the fire water system program in the BSEP LRA, Appendix A, Section A.1.1.11, which states that the fire water system 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 to 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 fire suppression system to perform its intended function.

Prior to the period of extended operation, program administrative controls will be enhanced to require assessing results from the initial 40-year service life tests and inspections to determine whether a representative sample of such results has been collected and whether expansion of scope and use of alternate test/inspection methods are warranted. Following enhancement, the fire water system program will be consistent with the corresponding program described in the GALL Report and subsequent NRC interim staff guidance.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.11, found that it was consistent with the GALL Report, as modified by ISG-04, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.11.7 Conclusion

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

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

## 2.12 ABOVEGROUND CARBON STEEL TANKS PROGRAM (BSEP AMP B.2.12)

In BSEP LRA, Appendix B, Section B.2.12, the applicant states that BSEP AMP B.2.12, Aboveground Carbon Steel Tanks Program," is a new program that is consistent with GALL AMP XI.M.29, "Aboveground Carbon Steel Tanks."

2.12.1 Program Description

The applicant states, in the BSEP LRA, 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. 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 states 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 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.

2.12.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.2.12 is consistent with the GALL AMP XI.M29.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.12, including the basis document: “Aboveground Carbon Steel Tanks Aging Management Program”, BNP-LR-630, Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M29. The project team also reviewed BSEP plant procedure CAP-NGGC-0202, “Operating Experience Program,” Revision 8.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.12 and associated bases documents against the GALL AMP XI.M29 for consistency.

The project team reviewed and 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 BSEP 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 applicant will also develop guidance concerning the frequency of inspections and the acceptance criteria for visual inspections. The project team 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.

The project team reviewed those portions of the BSEP AMP B.2.12, “Aboveground Carbon Steel Tanks Program," which the applicant claims is consistent with GALL AMP XI.M.29, “Aboveground Carbon Steel Tanks." and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.12.3 Exceptions to the GALL Report

None

2.12.4 Enhancements

None

2.12.5 Operating Experience

The applicant states, in the BSEP LRA, that:

- For the main fuel oil storage tank - NDE testing has been conducted on the emergency fire pump diesel fuel oil storage tank and each of the four DG 4-day fuel oil storage tanks. Problems relating to tank wall thickness degradation were not found on the subject tanks. This highlights the effectiveness of the fuel oil chemistry program in minimizing the loss of material within the fuel oil system
- For the condensate storage tanks (CST) – during inside tank inspections, corrosion products and coating film degradation were noted. The shell wall thickness readings were evaluated and found acceptable. The shell plates have experienced negligible corrosion. On the CST bottom plates, corrosion indications were noted on both the Unit 1 and Unit 2 tanks. In addition, the exterior of each CST has been inspected. External tank surface corrosion was identified on small portions of the shell wall. All areas were evaluated and found to be acceptable
- For the fire protection water storage tank - an inspection by a vendor determined that the tank is structurally sound. The tank foundation has some cracking, and the interior coating has some primer degradation. Both conditions have been evaluated as acceptable.

In discussions with the project team, the applicant stated that BSEP plan procedure CAP-NGGC-0202 is used to increase personnel's awareness of plant and industry operating experience so that lessons learned can be used to adjust BSEP aging management programs, as necessary. In its procedures, the applicant states 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 project team 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 project team concludes that the applicant's BSEP AMP B.2.12 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.12.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the aboveground carbon steel tanks program in the BSEP LRA, Appendix A, Section A.1.1.12, which states that the purpose of the aboveground carbon steel tanks program is to manage aging effects of loss of material by performing inspections of carbon steel fuel oil, condensate, and fire protection system tanks. The program includes measures to monitor corrosion or degradation by: (1) inspection of the external surfaces; (2) performing one-time volumetric examinations of tank bottoms; and, (3) preforming one-time inspections of all interior surfaces of the condensate storage tanks and fire protection water storage tank. When implemented, the aboveground carbon steel tanks program will be consistent with the corresponding program described in the GALL Report.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.12, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.12.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.13 FUEL OIL CHEMISTRY PROGRAM (BSEP AMP B.2.13)

In BSEP LRA, Appendix B, Section B.2.13, the applicant states that BSEP AMP B.2.13, “Fuel Oil Chemistry Program," is an existing plant program that will be consistent with GALL AMP XI.M30, “Fuel Oil Chemistry," with exceptions and enhancements.

### 2.13.1 Program Description

In the BSEP LRA the applicant states that the fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the guidelines of 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 fuel oil testing. Exposure to fuel oil contaminants, such as water and microbiological organisms is minimized by verifying the quality of new oil before it is introduced 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.

### 2.13.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that the fuel oil chemistry program is an existing program that will be consistent with GALL AMP XI.M30, with exceptions and enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.13, including BSEP calculation BNP-LR-631, “License Renewal Aging Management Program Description of the Fuel Oil Chemistry Program,” Rev. 2, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M30.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.13 and associated bases documents against the GALL AMP XI.M30 for consistency.

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 fuel oil contaminated with water and microbiological organisms.

The applicant states, in BSEP calculation BNP-LR-631, that the BSEP program is focused on managing conditions which can cause aging degradation of the internal surfaces of the in-scope components. The applicant states that BSEP technical specification 5.5.9, “Diesel Fuel Oil

Testing Program," requires testing of new and stored fuel oil and includes sampling requirements and acceptance criteria. The project team reviewed this technical specification and determined that it requires sampling and identifies implementing procedures OE&RC-1010, "Fuel Oil Sampling," Rev. 24, OE&RC-1142, "Particulate Contamination in Fuel Oil," Rev. 4, and OE&RC-1141, "Water and Sediment in Fuel Oil," Rev. 4. Technical specification 5.5.9 identifies two other implementing procedures, OE&RC-1138 and OE&RC-1020, but the applicant states that these are not credited for the extended period of operation. The project team reviewed OE&RC-1010, 1141, and 1142 and determined that these documents appropriately implement the periodic testing and acceptance requirements for fuel oil at BSEP.

The GALL Report discusses the potential benefit of tank coatings in preventing age degradation and recommends fuel oil quality monitoring for water and microbiological organisms, which can lead to loss of material on tank internal surfaces. The applicant states in BSEP calculation BNP-LR-631 that BSEP does not employ coatings for corrosion control. The applicant states that OE&RC-1010 specifies the frequency of fuel oil quality and water accumulation monitoring for the in-scope tanks. Microbiological growth is evaluated as needed based upon particulate testing results. The project team reviewed OE&RC-1010 and determined that it implements a program which specifically identifies fuel oil analysis sampling requirements and limits for new and stored fuel oil and the frequency of testing. The project team reviewed and determined that the applicant's program adequately monitors fuel oil 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 states that ASTM Standard D4057 is used for guidance on oil sampling. The applicant also states 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 in the following section. The applicant states that OE&RC-1010 requires multi-level, periodic sampling for the main and four-day tanks. The applicant states that the saddle tanks are much smaller in volume and subject to less variations in fuel oil properties. In accordance with OE&RC-1010, 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 project team 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 at BSEP is limited to the main fuel oil storage tank. The applicant indicates that a particular NDE method for use on this tank has not yet been identified. The applicant further responded that the extent of cleaning and/or surface preparation of the tank bottom will be appropriate for the chosen NDE technique. The applicant states that BSEP implementing procedure PMR 100789 will implement a preventive maintenance activity to inspect the main fuel oil storage tank on a ten-year frequency, which will include a visual inspection and thickness measurement of the tank bottom, as stated in the UFSAR Supplement. On the basis of this review, the project team reviewed and determined the applicants inspection plan for the main fuel oil storage tank meets the recommendations of the GALL Report.

The project team reviewed those portions of the BSEP AMP B.2.13, "Fuel Oil Chemistry Program," which the applicant claims is consistent with GALL AMP XI.M30, "Fuel Oil Chemistry," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately

manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.13.3 Exceptions to the GALL Report

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

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 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 fuel oil contaminated with water and microbiological organisms.

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

The GALL Report identified the following guidance for the scope of 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. The program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and microbiological organisms.

In the BSEP LRA, the applicant states that this reasoning can also be extended to managing the aging of metallic components in a fuel oil environment. The BSEP fuel oil chemistry program also specifies that new fuel be tested in accordance with ASTM D130-94 to assure fuel oil corrosion of copper alloy components in the diesel system is minimal. The applicant further states that these tests and controls ensure that fuel oil system components are exposed to contaminate-free fuel oil with minimal potential to corrode the interior surfaces of carbon steel, copper alloy and stainless steel components.

During the audit and review the project team asked the applicant to describe how aging will be managed for the other in-scope components "wetted" by fuel oil. In its letter dated March 14, 2005 (ML050810493), the applicant stated that the condition of the fuel oil storage tanks is considered to be a leading indicator that bounds other in-scope materials wetted by fuel oil. In the event aging degradation is detected in the in-scope fuel oil tanks, appropriate inspections and evaluations of other fuel oil system components will be directed by the corrective action program.

In a follow-up question, the project team asked the applicant to provide supporting information for its conclusion that the condition of the fuel oil storage tanks is a leading indicator that bounds other in-scope materials wetted by fuel oil, given that the environment may be different. In its response, the applicant summarized the BSEP AMR for components/materials wetted by fuel oil, which concluded that loss of material due to general, pitting, and microbiologically influenced

corrosion (MIC) is most likely to occur on the bottom surfaces of the carbon steel fuel storage tanks.

Discussions with the applicant's technical staff indicated that the fuel oil lines are primarily carbon steel with some brass fittings. Copper-alloy piping is used for the fire pump and some pressure transmitters. The applicants 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 project team reviewed this standard and determined that it is applicable to the grade of fuel oil used at BSEP.

The project team asked the applicant whether other AMPs are credited to manage aging of fuel oil piping. In its letter dated March 14, 2005 (ML050810493), the applicant stated that the Fuel Oil Chemistry Program is credited for managing the aging of the interior surface of all diesel fuel oil piping components as well as tanks. The external surfaces of buried fuel lines are managed by the buried piping and tanks inspection program.

On the basis that loss of material due to corrosion is most likely to occur on the bottom surfaces of the carbon steel tanks, that thickness measurements of the bottom surfaces will be taken as part of the program, and that unacceptable findings will trigger an investigation of other components, the project team reviewed and determined that the above exception is acceptable.

Exception 2

[Preventive Actions and Corrective Actions] The GALL Report identifies the following recommendations 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 BSEP Fuel Oil Chemistry Program does not currently use biocides, stabilizers, and corrosion inhibitors.

In the BSEP LRA, the applicant states that 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 fuel oil management activities, the addition of biocides, biological stabilizers, and corrosion inhibitors into stored fuel at BSEP is not necessary; however, the option is retained on an as needed basis."

The project team asked under what conditions would this option be implemented, and whether it be one-time or continuing. In its letter dated March 14, 2005 (ML050810493), the applicant stated that a combination of tank design and fuel oil management satisfactorily controls water, particulate, and sediment levels. Based on operating history and fuel oil management activities, the use of biocide, stabilizers, and corrosion inhibiting additives at BSEP has not been necessary. The potential exists that future fuel supplies may require additives to meet our stability and storage requirements. The future use of additives will be dependent on the attributes of the procured fuel and will be evaluated on a case-by-case basis. Adding a biocide, stabilizers, or additives will require an evaluation. The applicant also referenced its evaluation of NRC Information Notice 91-46, citing that storage tanks are maintained full to minimize internal

condensation, and that metal deactivators and corrosion inhibitors are added at the fuel oil refinery by the supplier.

The project team reviewed and determined that the BSEP fuel oil chemistry program is implemented by the following procedures: OE&RC-1010, 1141, 1142, 1138, and 1020. The project team reviewed OE&RC-1010, which implements the sampling procedure for the fuel oil. Attachment 1 of OE&RC-1010 specifies the inspection frequencies and acceptance limits for the fuel oil analysis. 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 project team also reviewed a summary of four years (2000-2004) of particulate testing for the four-day and main fuel oil storage tanks, contained in 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 also stated that BSEP uses Grade No. 2-D fuel oil at BSEP. The project team reviewed ASTM D975-88 and determined that it is applicable to Grade No. 2-D fuel oil.

The project team reviewed the applicant's implementing procedures for management of fuel oil at BSEP, including the periodic sampling of stored fuel oil, and determined that the applicant's program is adequate to maintain fuel oil quality. The project team's review of BSEP operating history supports the effectiveness of the program.

On the basis of the above information, the project team reviewed and determined that the exception is acceptable.

Exception 3

[Preventive Actions] The GALL Report identifies the following recommendations 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 BSEP LRA, the applicant states, the BSEP 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. Fuel oil 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 diesel generator 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. Fuel oil system design, procurement practices, and testing requirements assure that fuel oil 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 project team 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 project team also reviewed a four year sampling of data on sediments in the BSEP fuel oil tanks, which confirm the applicant's conclusion that there are no sediments in the tanks. On the basis of this review, the project team reviewed and determined that the exception to periodic cleaning is acceptable.

The GALL Report also identifies benefits associated with periodic draining. The project team noted that Section B.2.13 of the BSEP LRA identifies an exception to periodic cleaning of the fuel oil tanks, but does not specifically address periodic draining. The project team asked the applicant whether it also takes exception to periodic draining of tanks. In its letter dated March 14, 2005 (ML050810493), the applicant stated that there is no exception to the GALL Report recommendation to drain water from the diesel fuel oil tanks. This is an inherent feature of the Fuel Oil Chemistry Program. The applicant stated that the GALL Report discusses the benefits of fuel oil tank draining in two different contexts: one is for the removal of water and the other is as an adjunct to cleaning. BSEP sampling procedures include requirements for water removal (draining), should water be detected. With respect to draining as an adjunct to cleaning, the applicant has taken exception to periodic cleaning, on the basis that current plant operating experience has not shown a need to clean the fuel oil storage tanks. The applicant plans to conduct an internal inspection of the main fuel oil storage tank prior to the period of extended operation. If necessary, the tank will be drained and cleaned.

The project team concluded that the applicant's program includes periodic draining to remove water, consistent with the recommendations of the GALL report, and finds this acceptable.

Exception 4

[Parameters Monitored/Inspected and Acceptance Criteria] The GALL Report identifies the following recommendations for the parameters monitored/inspected and acceptance recommendations 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 Fm, instead of 0.8 Fm.

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

In the BSEP LRA, the applicant states that 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 fuel oil

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 fuel oil used at BSEP, because it is the prescribed method by ASTM D975-88.

The applicant further states that sampling of particulate contaminants, in accordance with ASTM D2276-89, is performed using a filter with a pore size of 0.8 Fm versus a pore size of 3.0 Fm as specified in the GALL Report. The GALL Report, 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 Fm, instead of 0.8 Fm. ASTM D2276 covers the test method for determination of particulate contaminants in aviation turbine fuel using a field monitor. At BSEP, fuel oil 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 Fm pore size as recommended in The GALL Report.

The project team confirmed that ASTM D975-88 references the use of ASTM D1796 for determining water and sediment and that it does not reference ASTM D2709. The project team reviewed this standard and concurs that it is applicable to the grade of fuel oil utilized at BSEP. Based on this, the project team reviewed and determined that the exception to using ASTM D2709 is acceptable. 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.

The project team reviewed the applicants exception to the filter pore size requirements of ASTM D2276-89. The project team reviewed ASTM D2276 and determined that it provides guidance on the sampling of particulate contamination in aviation fuel. The applicant states in BNP-LR-631 that the exception to using a smaller filter pore size than prescribed in ASTM D2276 will provide equivalent or superior results. The project team concurred with this reasoning and noted that this exception has been previously accepted at other facilities by the staff. The fact that the operating history at BSEP 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 project team concluded that these exceptions are acceptable.

Exception 5

[Detection of Aging Effects] The GALL Report identifies the following recommendations 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 BSEP LRA, the applicant states that tank internal inspection is limited to the main fuel oil storage tank. 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 high quality; non-corrosive, non-biologically-contaminated fuel oil 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 project team asked the applicant to specifically describe the features of the 4-day, saddle, and diesel fire pump tanks that make an internal inspection impractical. In its letter dated March 14, 2005 (ML050810493), the applicant reiterated its position stated in the BSEP LRA, and also stated that API-STD-653 allows the substitution of external tank inspections for internal inspections where bottom thickness can be determined by other means. BSEP will perform an external NDE inspection, consisting of a UT thickness measurement, on the bottom of these tanks.

The project team examined photographs of the 4-day, saddle, and diesel fire pump tanks, provided by the applicant's technical staff, and concurred that cleaning and a visual inspection would be difficult to perform and obtain meaningful results. In discussions, the applicant also stated that, as a follow-up to AR 69220, NDE examinations were completed on the emergency fire pump storage tank and several four-day storage tanks, and no problems relating to tank wall thickness degradation were found.

The project team asked the applicant for the results of previous external ultrasonic inspections. In its letter dated March 14, 2005 (ML050810493), the applicant stated:

> In accordance with the Corrective Action Program, on November 16, 2003, a non-destructive examination (NDE) was completed on the Emergency Fire Pump Diesel Fuel Oil Storage Tank, 2-FO-DIESEL-PMP-TK, and each of the four four-day fuel oil storage tanks, 2-FOD-4-DAY-TK-1, -2, -3, and -4 using NDEP-408. No problems relating to tank wall thickness degradation were found on any of the subject tanks. However, there were three locations on 2-FOD-4-DAY-TK-3 that indicated a potential wall thickness less than the typical thickness readings taken at various other locations on the tank.
>
> Each of the three locations indicated a point approximately 3 inch round and approximately ½ the normal wall thickness. The typical wall thickness indications were generally 0.47 inches with the subject three points reading approximately 0.20 inches. The indications noted were isolated indicating they contained embedded inclusions by the fabrication process, i.e. plate rolled steel. The inspection personnel stated they 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. Subsequent review of the examination data by a plant engineering staff knowledgeable in this area support the conclusion the three noted indications were not a tank wall degradation issue. No further action was required.

Based on these previous inspection results, the project team reviewed and determined that external NDE is an acceptable method for detecting aging degradation of these tanks. On the basis of this review, the project team concluded that the exception to internal tank inspections for the four-day tanks, the emergency diesel fire pump fuel oil tank, and the saddle tanks is acceptable.

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 project team concluded that the

exceptions stated by the applicant for BSEP AMP B.2.13 to the program elements for GALL AMP XI.M30 are acceptable.

2.13.4 Enhancements

In the BSEP 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 recommendations 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.

The project team noted that the applicant's exception to detection of aging effects, which is discussed above, is related to this enhancement. The project team concurs that performance of an internal inspection on the main fuel oil storage tank, and NDE thickness measurements of in-scope tanks under the one-time inspection program (BSEP AMP Section B.2.15) are consistent with the GALL Report recommendations. The project team reviewed the scope of BSEP AMP B.2.15 and determined that it includes inspection of the in-scope fuel oil storage tanks. Therefore, the project team concluded that this enhancement is acceptable.

Enhancement 2

[Monitoring and Trending] The Gall Report identifies the following recommendations 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 administrative controls will be enhanced to add a requirement to trend sampling data for water and particulates.

The applicant states in BNP-LR-631 that water and particulates are monitored at least quarterly, and biological growth evaluations are run on samples from tanks if the particulate contamination levels appear to be increasing at the discretion of the E&RC supervisors. The project team reviewed OE&RC-1010 and confirmed the implementation of the quarterly testing. This 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. The applicant indicated that the OE&RC will be modified to trend the data for water and particulates. The project team reviewed AR 100627-46 Action Plan, which details the commitment implementation action for this enhancement.

In response to a project team question, the project team inquired whether any upgrades are

currently planned for the fuel oil chemistry program. In its letter dated March 14, 2005 (ML050810493), 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 can not be performed. The project team noted that the GALL Report does not specify specific revisions to ASTM standards. The change to an alternate standard for particulate testing will ensure adequate particulate calculations. The project team concluded that the identified upgrades are appropriate.

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

On the basis of its review of the above enhancements, the applicant's responses to audit questions, and discussions with the applicant's technical staff, the project team concluded that the enhancements stated by the applicant for BSEP AMP B.2.13 to make it consistent with the program elements for GALL AMP XI.M30 are acceptable.

2.13.5 Operating Experience

The applicant states, in the BSEP LRA, 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, performed by the applicant, did not identify any instances of water in the fuel, particulate contamination, or biological fouling. No fuel oil system component failures attributed to fuel oil contamination have been identified.

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 which the applicant claims are representative of 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 in BSEP calculation BNP-LR-631 identified potential fuel oil quality issues that could have impacted operability (new fuel oil shipments with lower than acceptable flash points, unannounced fuel oil 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 fuel oil transfer line between the main fuel oil 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 fuel oil quality to verify these were consistent with the EDG vendor recommendations and applicable industry standards. All BSEP fuel oil program practices were found to be satisfactory.

The project team selected several adverse condition investigation reports and NCR's and reviewed the applicants conclusions. Adverse condition report AR 69220 (8/19/02) evaluated the need for additional, or more restrictive, sampling procedures for newly received or stored fuel oil. The applicant concluded that the current practices were adequate, but should be re-evaluated if a different fuel oil supplier is used. No changes were found to be needed to the current fuel oil storage practices for the main fuel oil storage tank, which call for the tank to be filled to heights greater than 20 feet to minimize condensation. The project team also reviewed Attachment 2 to BSEP calculation BNP-LR-631, which provided fuel oil particulate trend levels in the 4-day and main fuel oil storage tanks. It was noted that water contamination was not provided since the periodic samples taken produced no indication of water.

On the basis of its review of the above plant-specific operating experience and on discussions with the applicant's technical staff, the project team concludes that the applicant's BSEP AMP B.2.13 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.13.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the fuel oil chemistry program in the BSEP LRA, Appendix A, Section A.1.1.13, which states:

> Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the guidelines of the American Society for Testing Materials (ASTM) Standards specified in the BSEP Technical Specification Bases applicable to the surveillance requirements for fuel oil testing. Exposure to fuel oil 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. Effectiveness of the program is verified using thickness measurements of tank bottom surfaces to ensure that significant degradation is not occurring. Prior to the period of extended operation: (1) program administrative controls will be enhanced to add a requirement to trend data for water and particulates; (2) the condition of the in-scope fuel oil tanks will be verified by means of thickness measurements under the One-Time Inspection Program; and, (3) an internal inspection of the main fuel oil storage tank will be performed under the One-Time Inspection Program.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.13, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.13.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those

program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team has reviewed the enhancements and determined that the implementation of the enhancements prior to the period of extended operation would result in the existing aging management program being consistent with the GALL program to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.14 ONE-TIME INSPECTION PROGRAM (BSEP AMP B.2.15)

In BSEP LRA, Appendix B, Section B.2.15, the applicant states that BSEP AMP B.2.15, "One-Time Inspection Program," is a new program that will be consistent with AMP XI.M32, "One-Time Inspection," in the GALL Report, with an exception and an enhancement.

### 2.14.1 Program Description

The applicant states, in the BSEP LRA, that this 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 includes inspections specified by the GALL Report, as well as plant-specific inspections. The one-time inspection program is credited for aging management of a number of structures and components.

### 2.14.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.15 will be consistent with GALL AMP XI.M32, with an exception and an enhancement.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.15, including BSEP calculation No. BNP-LR-632, "License Renewal Aging Management Program Description of the One-Time Inspection Program," Rev.1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M32.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.15 and associated bases documents against the GALL AMP XI.M32 for consistency.

In the BSEP LRA, the applicant states 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 unacceptable degradation is not occurring, and determines the need for additional aging management for structures/components that are currently not managed by other AMPs. As described in BSEP calculation BNP-LR-632 Attachments 2 and 3, the program includes a verification of the effectiveness of both the water chemistry and fuel oil chemistry programs. The program also

includes a number of non-GALL inspections based on plant specific aging management reviews, and these are described in Attachments 4 through 18 of calculation BNP-LR-632. The project team compared the scope of the one-time inspection program to that described in BSEP calculation BNP-LR-600 for the water chemistry program and calculation BNP-LR-631 for the fuel oil chemistry program. For both programs the scope and methods was found to be consistent with the one-time inspection program.

In BSEP calculation BNP-LR-632, the applicant states that each structure/component inspected under its one-time inspection program is evaluated against a unique set of considerations based upon 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 states that inspection methods will include a variety of NDE methods (visual, volumetric, and surface techniques) performed by qualified personnel and use applicable codes and standards in accordance with Appendix B quality assurance requirements. The project team reviewed and 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. In calculation BNP-LR-632, the applicant states 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 states that, where feasible, it is acceptable to use like material and environment combinations in alternate components/systems for verification of the water chemistry program.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that:

> Consistent with the GALL Program description in XI.M32, the one--time inspection for aging management program effectiveness verification will include: (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow--up examinations to monitor the progression of any aging degradation. The details of this inspection plan, including identification of specific sampling techniques and inspection locations, will be formalized prior to the end of the current license term.

The GALL Report states that one-time inspections are to be completed before the end of the current operating license. The project team asked the applicant to describe the timing of the one-time inspections relative to the onset of the extended period of operation. In its response, the applicant stated that 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 mid part of the 4$^{th}$ quarter of the current licensing period and the results will be evaluated in accordance with site procedures. The project team reviewed and determined that this is consistent with the recommendations in the GALL Report.

The project team 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 project team 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. In its response, the applicant stated that the BSEP program is consistent with the GALL Report since they are using calculation BNP-LR-600 (water chemistry program) and calculation BNP-LR-631 (fuel oil chemistry) and using the 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 aging management program, one of the following applies: (a) an aging effect is not expected to occur but the data is 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 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 effects will have accumulated before inspections are performed and that this time period will be sufficient for the aging effects to manifest. The one-time inspection program will either validate the correctness of these expectations or serve as a basis for subsequent corrective actions. The project team reviewed and determined that this approach is consistent with the recommendations of the GALL Report and is acceptable.

In BSEP calculation BNP-LR-632, the applicant states 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 CAP-NGGC-0200. The project team, in its review of the diesel fuel oil program, confirmed that one-time thickness inspections of in-scope tanks will be compared against the as-built tank thickness measurements. The project team reviewed and determined that the applicant's approach is consistent with the recommendations in the GALL Report, and is acceptable.

The project team reviewed those portions of the BSEP AMP B.2.15, "One-Time Inspection Program," which the applicant claims is consistent with GALL AMP XI.M32, "One-Time Inspection," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.14.3 Exceptions to the GALL Report

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

Exception 1

[Scope of Program and Detection Of Aging Effects]

The GALL Report identifies the following recommendations for the scope of 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).

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 Risk Informed Inservice Inspection Program at BSEP and by lack of operating experience indicating 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 risk informed inservice inspection 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 stress corrosion cracking of these lines is bounded by those components selected for inservice inspection as part of Risk Informed 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 project team advised the applicant that the staff 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, 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 further 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 reactor coolant system pressure boundary and are part of the reactor coolant pressure boundary can be excluded from the requirements set forth in Code Class 1 components, provided 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 reactor coolant pressure boundary 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 states 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 aging management reviews 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 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 and ASME Section XI (IWB, IWC, and IWD) programs will be credited for aging management of small bore piping. These components will be subject to physical leakage inspections under ASME Section XI the one-time inspection program will be used to verify the effectiveness of these programs.

After review of the applicant's initial response, the project team informed the applicant that the staff does not accept criterion 1, as defined in the applicant's response, as a basis for exclusion from the small bore piping inspection scope.

In its letter dated March 14, 2005 (ML050810493), the applicant revised its response to state the following: :

> 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 10CFR50, 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. The applicant may schedule the inspection in such a way as to minimize the impact on plant operations. However, the inspection is not to be scheduled too early in the current operating term, which could raise questions regarding continued absence of aging effects prior to and near the extended period of operation.

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 BSEP One-Time Inspection Program as described above, the program will be consistent with the program description found in NUREG 1801, Aging Management Program 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 project team reviewed and 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.

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 project team concluded that the exceptions stated by the applicant for BSEP AMP B.2.15 to the program elements for GALL AMP XI.M32 are acceptable.

Additionally, the project team requested that the applicant identify all required revisions to the BSEP LRA in order to be consistent with its new commitment and to include small bore Class 1 piping in the scope of the one-time inspection program. In its letter dated May 4, 2005 (ML051330020), the applicant identified the revisions to the BSEP LRA specifying how BSEP will use the One-Time Inspection Program for aging management of small-bore Class 1 piping inspections regarding cracking due to thermal and mechanical loading and SCC. The revision includes specifying the ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program and the Water Chemistry Program for aging management, and use of the One-Time Inspection Program for verification of program effectiveness, consistent with the recommendations of GALL. Also, the ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program will no longer credit RI-ISI in aging management.

Based on the applicant's new commitment to include small bore Class 1 piping in the scope of

the one-time inspection program and to revise the BSEP LRA as identified above, this exception is no longer applicable and will be deleted from BSEP LRA Section B.2.15. The project team finds this resolution to be acceptable, on the basis that the applicant's one-time inspection program will be consistent with the GALL report.

2.14.4 Enhancements

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

[Scope of Program] The GALL Report identifies the following recommendations for scope of 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 project team asked the applicant why a new program, which has not been completely defined, would have an enhancement. In its response, the applicant stated that the term enhancement was used to identify 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, BSEP committed to developing procedural controls to implement the inspection activities.
The project team reviewed and 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 above enhancement, the applicant's responses to audit questions, and discussions with the applicant's technical staff, the project team concluded that the enhancement stated by the applicant for BSEP AMP B.2.15 to make it consistent with the program elements for GALL AMP XI.M32 is acceptable.

2.14.5 Operating Experience

The applicant states, in the BSEP LRA, that the one-time inspection program is a new program and that 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 project team reviewed the applicant's application of the one-time inspection program to verify the effectiveness of 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 project team concluded that the applicant's program, as revised to address project team concerns, will be effective in accomplishing the objectives of the one-time inspection program, on the basis that it will be consistent with GALL AMP XI.M32.

The project team 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.

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 project team concludes that the applicant's BSEP AMP B.2.15 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.14.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the one-time inspection program in the BSEP LRA, Appendix A, Section A.1.1.15, which states that:

- 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
- 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 project team reviewed the UFSAR Supplement for BSEP AMP B.2.15 in the BSEP LRA, 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 project team 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. In its letter dated May 4, 2005 (ML051330020), the applicant identified the following revision to the BSEP LRA 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.

Based on this additional commitment, the project team found that the UFSAR supplement for BSEP AMP B.2.15, is consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.14.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team has reviewed the enhancement and determined that the implementation of the enhancement prior to the period of extended operation would result in the existing aging management program being consistent with the GALL program to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the UFSAR supplement for this AMP and finds that it provides

an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.15 SELECTIVE LEACHING OF MATERIALS PROGRAM (BSEP AMP B.2.16)

In BSEP LRA, Appendix B, Section B.2.16 , the applicant states that BSEP AMP B.2.16, “Selective Leaching of Materials Program," is a new program that is consistent with GALL AMP XI.M33, “Selective Leaching of Materials," with an exception.

### 2.15.1 Program Description

The applicant states, in the BSEP LRA, 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. 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 states 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. Evidence suggesting the presence of selective leaching will result in expanded sampling, as appropriate, and engineering evaluation.

### 2.15.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.16 is a new program that is consistent with GALL AMP XI.M33, with an exception.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.16, including BSEP calculation No. BNP-LR-633, “Selective Leaching Of Materials Program”, Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M33. The project team also reviewed BSEP plant procedure, CAP-NGGC-0202, “Operating Experience Program,” Revision 8.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.16 and associated bases documents against the GALL AMP XI.M33 for consistency.

The project team reviewed those portions of the BSEP AMP B.2.16, “Selective Leaching of Materials Program," which the applicant claims is consistent with GALL AMP XI.M33, “Selective Leaching of Materials," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

### 2.15.3 Exceptions to the GALL Report

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

[Scope of Program, Preventive Actions, Parameters Monitored/Inspected, Detection of Aging Effects, and Monitoring and Trending] The GALL Report identifies the following recommendations 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 project team reviewed the applicant's exception and determined that it is justified on the basis that: (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 which may be susceptible to selective leaching. The project team considered the applicant's justification to be reasonable and acceptable.

On the basis of its review of the above exception, the project team concluded that the exceptions stated by the applicant for BSEP AMP B.2.16 to the program elements for GALL AMP XI.M33 are acceptable.

2.15.4 Enhancements

None

2.15.5 Operating Experience

During the audit and review the project team reviewed operating experience for the applicant's selective leaching of material program. The applicant states, in the BSEP LRA, Appendix B, Section B.2.16, that there is operating experience at BSEP 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.

The project team asked the applicant how operating experience is captured. The applicant indicated that BSEP plant procedure, CAP-NGGC-0202, "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 aging management program, as necessary. In its procedure, the applicant states that it provides guidance for using, sharing, and evaluating operating experience at Nuclear Generation Group (NGG) sites, as well as promoting the identification and transfer of lessons learned by industry. The project team 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 project team concludes that the applicant's BSEP AMP B.2.16 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.15.6 UFSAR Supplement

The applicant, in BSEP LRA, Appendix A, Section A.1.1.16, provides its UFSAR Supplement for the selective leaching of materials program. The applicant states that the selective leaching of materials program includes one-time inspections and qualitative determinations of selected components that may be susceptible to selective leaching. A sample population of susceptible components will be selected for the inspection and testing prior to commencing the period of extended operation. The inspection and testing 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.

With inclusion of quantitative testing, the program will be consistent with GALL AMP XI.M33 with one exception involving the use of qualitative determinations other than Brinell hardness testing to identify the presence of selective leaching of material.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.16, found that it was consistent with the GALL Report, with exceptions, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR Supplement table and as required by 10 CFR 54.21(d).

2.15.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

2.16 BURIED PIPING AND TANKS INSPECTION PROGRAM (BSEP AMP B.2.17)

In BSEP LRA, Appendix B, Section B.2.17, the applicant states that BSEP AMP B.2.17, "Buried Piping and Tanks Inspection Program," is a new program that is consistent with GALL AMP XI.M34, ""Buried Piping and Tanks Inspection," with exceptions.

2.16.1 Program Description

The applicant states, in the BSEP LRA, 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 to mitigate degradation (e.g., coatings and wrappings required by design); 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 states that this program will be implemented prior to the period of extended operation and will include procedural requirements to: (1) ensure 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.

2.16.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.17 is consistent with GALL AMP XI.M34, with exceptions.

During the audit and review the project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.17, including BSEP calculation No. BNP-LR-634 "Buried Piping and Tanks Inspection Program," Revision 0, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M34. The project team also reviewed BSEP plant procedure, CAP-NGGC-0202, "Operating Experience Program," Revision 8.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.17 and associated bases documents against the GALL AMP XI.M34 for consistency.

The project team reviewed those portions of the BSEP AMP B.2.17, "Buried Piping and Tanks Inspection Program," which the applicant claims is consistent with GALL AMP XI.M34, ""Buried Piping and Tanks Inspection," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.16.3 Exceptions to the GALL Report

In the BSEP LRA, the applicant states 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 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 NUREG-1801 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 project team reviewed and 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 project team concluded that the exception is

acceptable.

Exception 2

[Detection of Aging Effects] The GALL Report identifies the following recommendations 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: NUREG-1801 refers to periodic inspections with a scheduled frequency. BSEP, however, intends to inspect buried piping only when 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 project team noted that the applicant plans to perform periodic buried piping inspections, which will be opportunistic inspections during maintenance activities. The project team informed the applicant that opportunistic inspections qualify; however, there must also be a commitment to perform periodic inspections at least once every ten (10) years. Opportunistic inspections can qualify for the periodic inspections.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that it will revise the buried piping and tanks inspection program to do periodic inspections of buried piping. The applicant states that opportunistic inspection may be used to satisfy inspection requirements, but in no case will the frequency of inspection exceed 10 years.

The project team 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 above exceptions, the applicant's responses to audit questions, and discussions with the applicant's technical staff, the project team concluded that the exceptions stated by the applicant for BSEP AMP B.2.17 to the GALL AMP XI.M34 are acceptable.

2.16.4 Enhancements

None

2.16.5 Operating Experience

The project team reviewed operating experience for the applicant's buried piping and tanks inspection program. The applicant states, in the BSEP LRA, that industry operating experience has shown that carbon steel and cast iron buried components have experienced corrosion degradation. Critical areas include those at the interface where the component transitions from

above ground to below ground. This is an area where coatings are often missing or damaged.

The applicant also states that leaks have occurred in BSEP buried piping components and have been repaired, which demonstrates that leaks have been detected and that appropriate corrective actions have been taken. The applicant conducts pressure tests of safety-related service water system buried piping to ensure adequate flow delivery in accordance with technical specification requirements.

The applicant concludes that, on the basis of 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.

During the audit and review the project team asked the applicant how operating experience is captured. The applicant indicated that plant procedure, CAP-NGGC-0202, "Operating Experience Program," is used to increase personnel's awareness of plant and industrial operating experience so that lesson learned can be used to adjust its aging management program, as necessary. In its procedure, the applicant states that it provides guidance for using, sharing, and evaluating operating experience at Nuclear Generation Group (NGG) sites as well as promoting the identification and transfer of lessons learned by the industry. The project team 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 project team concludes that the applicant's BSEP AMP B.2.17 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.16.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the buried piping and tanks inspection program in the BSEP LRA, Appendix A, Section A.1.1.17. The project team noted that the supplement failed to include a defined frequency for conducting the buried piping and tanks inspection, as recommended by the GALL Report. In its letter dated March 14, 2005 (ML050810493), the applicant committed to an inspection frequency not to exceed 10 years and revised the UFSAR Supplement to read:

> Buried Piping and Tanks Inspection Program manages the aging effect of loss of material for the external surfaces of buried piping components in BSEP systems in scope for license renewal. There are no buried tanks in this program. The program includes preventive measures to mitigate corrosion by protecting the external surfaces of buried piping components through use of coating or wrapping. The program includes visual examinations of buried piping components on a frequency not to exceed 10 years.
>
> The program will be implemented prior to the period of extended operation and will include procedural requirements to: (1) ensure 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.

The project team reviewed the revised UFSAR Supplement for BSEP AMP B.2.17, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.16.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

2.17 ASME SECTION XI, SUBSECTION IWE PROGRAM (BSEP AMP B.2.18)

In BSEP LRA, Appendix B, Section B.2.18, the applicant states that BSEP AMP B.2.18, "ASME Section XI, Subsection IWE Program," is an existing plant program that is consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE."

2.17.1 Program Description

The applicant states, in the BSEP LRA, 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 10CFR50.55a. 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 states 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.

2.17.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.2.18 is consistent with the GALL AMP XI.S1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.18, including calculation BNP-LR-616, "License Renewal Aging Management Program Description of the ASME Section XI, Subsection IWE," Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.S1.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.18 and associated bases documents against the GALL AMP XI.S1 for consistency.

During the audit and review the project team asked the applicant to clarify the following statement under "NUREG 1801 Consistency" in the BSEP LRA: "10 CFR 50.55a governs the application of Codes and Standards. Therefore, differences between the BSEP Code of Record and Code edition specified in NUREG 1801 are not considered to be an exception to NUREG 1801." The project team noted that under "Program Description" in the BSEP LRA, the referenced Code edition is consistent with NUREG 1801.

In its response, the applicant stated:

> 10 CFR 50.55a allows the licensee to use either the 1992 Edition with the 1992 Addenda or the 1995 Edition with the 1996 Addenda of Subsection IWE. BSEP has committed to use the 1992 Edition with the 1992 Addenda. The NUREG-1801 program description addresses both the 1992 and 1995 Editions. The intent of the statement was to clarify that BSEP is consistent with the 1992 Edition and a comparison/consistency review with the Edition is not required to establish consistency with GALL. This position is supported by past precedence from other applications."

The project team concurred that it is not necessary to perform a comparison/consistency review of the applicant's program to the 1995 edition of IWE, and determined that the applicant's implementation of ASME Code, Section XI, Subsection IWE, 1992 Edition, with the 1992 Addenda, as modified by 10CFR50.55a, is consistent with the GALL Report. The 1992 Addenda acceptance is in NUREG-1611.

The project team asked the applicant to describe the pressure retaining bolting included in the IWE scope, specifically whether it includes low alloy, high strength bolts (actual Sy $\geq$ 150 ksi), and what inspections are performed. In its response, the applicant stated that the pressure retaining bolting is identified in Appendix A and Appendix B of BNP-TR-002. There are no high strength bolts within this group. Inspection results are provided in the hard copy of 0PT-20.5.1.

The project team reviewed the referenced documents and concluded that there is no pressure retaining bolting in the scope of IWE that would require augmented inspection to detect cracking. On that basis, the project team reviewed and determined that visual inspection of bolting is acceptable.

The project team 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 Appendix F of BNP-TR-002.

The project team reviewed those portions of the BSEP AMP B.2.18, "ASME Section XI, Subsection IWE Program," which the applicant claims is consistent with GALL "ASME Section XI, Subsection IWE," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.17.3 Exceptions to the GALL Report

None

2.17.4 Enhancements

None

2.17.5 Operating Experience

The applicant states, in the BSEP LRA, 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 states 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.

Based on review of this document and follow-up discussions with the applicant's technical staff, the project team 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.

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 project team concludes that the applicant's BSEP AMP B.2.18 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.17.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the ASME Section XI, Subsection IWE program in the BSEP LRA, Appendix A, Section A.1.1.18, which states that the ASME Section XI, Subsection IWE Program consists of periodic inspection of steel containment components for signs of degradation, assessment of damage, and corrective actions; the program is in accordance with ASME Section XI, Subsection IWE, 1992 Edition, including 1992 Addenda, and in accordance with 10 CFR 50.55a. The ASME Section XI, Subsection IWE Program is consistent with the corresponding program described in The GALL Report.

The project team reviewed the UFSAR supplement for AMP B.2.18, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the

program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.17.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.18 ASME SECTION XI, SUBSECTION IWL PROGRAM (BSEP AMP B.2.19)

In BSEP LRA, Appendix B, Section B.2.19 , the applicant states that BSEP AMP B.2.19, “ASME Section XI, Subsection IWL Program," is an existing plant program that is consistent with GALL AMP XI.S2, “ASME Section XI, Subsection IWL Program," with an exception.

2.18.1 Program Description

The applicant states, in the BSEP LRA, 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 posttensioning system; therefore, the ASME Code, Section XI, Subsection IWL requirements associated with a post-tensioning system are not applicable.

2.18.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.19 is consistent with GALL AMP XI.S2, with an exception.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.19, including BSEP calculation BNP-LR-617, “License Renewal Aging Management Program Description of the ASME Section XI, Subsection IWL," Revision 1, which provides an assessment of the AMP’s consistency with AMP XI.S2 in the GALL Report.

The project team asked the applicant to clarify the following statement under "NUREG 1801 Consistency" in the BSEP LRA: "10 CFR 50.55a governs the application of Codes and Standards. Therefore, differences between the BSEP Code of Record and Code edition specified in NUREG 1801 are not considered to be an exception to NUREG 1801." The project team noted that under "Program Description" in the BSEP LRA, the referenced code edition is consistent with NUREG 1801.

In its response, the applicant stated:

> 10 CFR 50.55a allows the licensee to use either the 1992 Edition with the 1992 Addenda

> or the 1995 Edition with the 1996 Addenda of Subsection IWL. BSEP has committed to use the 1992 Edition with the 1992 Addenda. The NUREG-1801 program description addresses both the 1992 and 1995 Editions. The intent of the statement was to clarify that BSEP is consistent with the 1992 Edition and a comparison/consistency review with the Edition is not required to establish consistency with GALL. This position is supported by past precedence from other applications.

The project team concurred that it is not necessary to perform a comparison/consistency review of the applicant's program to the 1995 edition of IWL and determined that the applicant's implementation of ASME Code, Section XI, Subsection IWL, 1992 Edition, with the 1992 Addenda, as modified by 10CFR50.55a, is consistent with the GALL Report.

The project team reviewed those portions of the BSEP AMP B.2.19, "ASME Section XI, Subsection IWL Program," which the applicant claims is consistent with GALL "ASME Section XI, Subsection IWL Program," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.18.3 Exceptions to the GALL Report

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

[Scope of Program] The GALL Report identifies the following recommendations for the scope of program AMP 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 BSEP 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 on discussions with the applicant's technical staff, the project team concluded that the exception stated by the applicant for BSEP AMP B.2.19 to the program element for GALL AMP XI.S2 is acceptable.

2.18.4 Enhancements

None

2.18.5 Operating Experience

The applicant states, in the BSEP LRA, 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 states 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 BSEP 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.

During the audit and review the project team 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 at BSEP.

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 project team concludes that the applicant's BSEP AMP B.2.19 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.18.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the ASME Section XI, Subsection IWL program in the BSEP LRA, Appendix A, Section A.1.1.19, which states that:

> The ASME Section XI, Subsection IWL Program is credited for the aging management of accessible and inaccessible pressure retaining Primary Containment concrete for both BSEP Units. The BSEP containment structures do not use prestressing tendons. Therefore, ASME Section XI, Subsection IWL rules regarding post-tensioning systems are not applicable. This Program is in accordance with ASME Section XI, Subsection IWL, 1992 Edition, including 1992 Addenda, and in accordance with 10 CFR 50.55a. The ASME Section XI, Subsection IWL Program is consistent with the corresponding program described in NUREG-1801 with the exception of requirements associated with a post-tensioning system are not applicable.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.19, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.18.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.19 ASME SECTION XI, SUBSECTION IWF PROGRAM (BSEP AMP B.2.20)

In BSEP LRA, Appendix B, Section B.2.20, the applicant states that BSEP AMP B.2.20, “ASME Section XI, Subsection IWF Program," is an existing plant program that will be consistent with GALL AMP XI.S3, “ASME Section XI, Subsection IWF," with enhancement.

### 2.19.1 Program Description

The applicant states, in the BSEP LRA, 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.

### 2.19.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.20 will be consistent with GALL AMP XI.S3, with enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.20 including BSEP calculation BNP-LR-618, “License Renewal Aging Management Program Description of the ASME Section XI, Subsection IWF,” Revision 0, which provides an assessment of the AMP elements' consistency with GALL AMP XI.S3.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.20 and associated bases documents against the GALL AMP XI.S3 for consistency.

During the audit and review the project team asked the applicant to clarify the following statement under "NUREG 1801 Consistency" in the BSEP LRA: "10 CFR 50.55a governs the application of Codes and Standards. Therefore, differences between the BSEP Code of record and Code edition specified in NUREG 1801 are not considered to be an exception to NUREG 1801." The project team noted that under "Program Description" in the BSEP LRA, the referenced code edition is consistent with NUREG 1801.

In its response, the applicant stated:

> The BSEP ASME Section XI, Subsection IWF ISI program is implemented through ASME Code Case N-491 in accordance with 10 CFR 50.55a. NUREG-1801 does not specifically address Code Case N-491; however, comparison of the NUREG-1801 program elements to the BSEP implementation of Code Case N-491 has shown the

program to be consistent. Therefore the IWF program was determined to be consistent despite the fact that Code Case N-491 is not specifically addressed in the NUREG-1801 program description. This position is supported by past precedence from other applications.

The project team reviewed ASME Code Case N-491, and concluded that it is consistent with the 1990 addenda to the 1989 edition of ASME Section XI, Subsection IWF. On this basis, the project team reviewed and determined that the applicant's implementation of ASME Code Case N-491 is consistent with the GALL Report.

The project team reviewed those portions of the BSEP AMP B.2.20, "ASME Section XI, Subsection IWF Program," which the applicant claims is consistent with GALL AMP XI.S3, "ASME Section XI, Subsection IWF," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.19.3 Exceptions to the GALL Report

None

2.19.4 Enhancements

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

[Scope of Program] The GALL Report identifies the following recommendations 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.

The project team 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 project team 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. The torus vent system supports are not currently in the scope of IWF. However, BSEP has committed to include them within the scope of IWF prior to the period of extended operation. In a follow-up discussion with the applicant's technical staff, the project team reviewed and determined that the torus vent system supports are currently included within the scope of the applicant's IWE program.

The project team reviewed and determined that inclusion of these Class MC supports within the scope of the applicant's IWF program is a necessary enhancement, in order to be consistent with the GALL Report. On this basis, the project team reviewed and determined this enhancement to be acceptable.

On the basis of its review of the above enhancement, the applicant's responses to audit questions, and discussions with the applicant's technical staff, the project team concluded that the enhancement stated by the applicant for BSEP AMP B.2.20 to make it consistent with the program elements for GALL AMP XI.S3 is acceptable.

2.19.5 Operating Experience

The applicant states, in the BSEP LRA, 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 states 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 BSEP ASME Section XI, Subsection IWF 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.

Based on discussions with the applicant's technical staff, the project team reviewed and determined that there are no augmented inspections currently being performed for supports in the scope of the applicant's IWF program. The project team noted that BSEP LRA Section 4.7.4 describes a TLAA for the torus vent system supports:

> 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 (Ultrasonic) 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 project team 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 project team reviewed and 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 industry and plant-specific operating experience and on discussions with the applicant's technical staff, the project team concludes that the applicant's BSEP AMP B.2.20 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.19.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the inspection of the ASME Section XI, Subsection IWF program in the BSEP LRA, Appendix A, Section A.1.1.20, which states that:

> The ASME Section XI, Subsection IWF Program consists of periodic visual examination of component supports for loss of material and loss of mechanical function. This program is in accordance with ASME Section XI, Subsection IWF, 1989 Edition, and in accordance with ASME Code Case N-491. Prior to the period of extended operation, the program will be enhanced to include the torus vent system supports within the scope of the program. Following enhancement, the ASME Section XI, Subsection IWF Program will be consistent with the corresponding program described in NUREG-1801.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.20, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.19.7 Conclusion

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

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

2.20 10 CFR PART 50, APPENDIX J PROGRAM (BSEP AMP B.2.21)

In BSEP LRA, Appendix B, Section B.2.21, the applicant states that BSEP AMP B.2.21, "10 CFR Part 50, Appendix J Program," is an existing plant program that is consistent with GALL AMP Section XI.S4, "10 CFR Part 50, Appendix J ."

2.20.1 Program Description

The applicant states, in the BSEP LRA, that the 10 CFR Part 50, Appendix J program is structured in accordance with the requirements of 10 CFR 50, Appendix J, and assures the required performance-based leak testing of the containment and its penetrations. The program is an acceptable method for verifying, through testing, the management of aging effects for containment integrity as documented in NUREG-1801, Chapter II. 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 50, Appendix J and the guidelines contained in Regulatory Guide 1.163, September 1995, and NEI 94-01, "Industry Guideline for Implementing Performance Based Option of 10 CFR Part 50, Appendix J."

2.20.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.2.21 is consistent with the GALL AMP XI.S4.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.21, including BSEP calculation BNP-LR-615 "License Renewal Aging Management Program Description of the 10 CFR 50 Appendix J Containment Leak Rate Test (LRT) Program," Rev.0, which provides an assessment of the AMP elements' consistency with GALL AMP XI.S4.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.21 and associated bases documents against the GALL AMP XI.S4 for consistency.

The GALL Report specifies that the scope of the containment LRT program include all pressure-retaining components. Type A tests are performed to measure the overall primary containment integrated leakage rate (ILRT) and Type B tests measure local leakage rates across each pressure-containing or leakage-limiting boundary for containment penetrations. The applicant states that the BSEP containment LRT program includes all pressure-retaining components. BSEP procedure OENP-16.8 "Containment Leakage Tracking" Rev. 21, establishes the administrative requirements for the preparation, approval, performance, and evaluation of 10 CFR 50 Appendix J testing. The project team reviewed OENP-16.8, Rev. 21, and determined that it establishes administrative controls and limits for Option B Type A and B tests in accordance with 10 CFR 50, Appendix J, and the guidelines of RG 1.163, "Performance-Based Containment Leak-Test Program," issued September 1995, and NEI 94-01, "Industry Guideline for implementing Performance-Based Option of 10 CFR PART 50 Appendix J," issued January 26, 1995.

The applicant states, in BSEP calculation BNP-LR- 615, that BSEP uses Option B, which allows a variable risk-informed testing schedule for Types A and B testing. The applicant states that program implementation is through BSEP procedures: OPT-20.5 "Integrated Primary Containment Leak Rate Test (ILRT)" Rev. 46; OPT-20.3B "Local Leak Rate Testing of the Personnel Airlock" Rev. 10; OPT-20.3C "Personnel Airlock Interior and Exterior Doors Leak Rate Test" Rev. 8; OPT-20.3 "Local Leak Rate Testing" Rev. 57; and OPT-20.5.1 "Primary Containment Inspection" Rev. 13. The project team reviewed OPT-20.5, -20.3B, -20.3C, -20.3, and -20.5-1 and determined that they direct the processes necessary to test the BSEP containment and all penetrations in accordance with 10 CFR 50 Appendix J.

During the audit and review the project team inquired if Appendix J, Type C testing is credited for

aging management for license renewal. The applicant responded that 10 CFR 50, Appendix J, Type C testing of containment isolation valves at BSEP is performed in accordance with Option B. However, it is not a credited aging management activity for license renewal at BSEP. The project team reviewed and determined that the applicants 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 applicant states that OENP-16.8 “Containment Leakage Tracking” Rev. 21, in combination with OPT-20.5, -20.3B, -20.3C, -20.3, and -20.5-1, monitors the leakage rates at BSEP through Type A and B testing. The project team reviewed OENP-16.8 and determined that it defines the administrative requirements and controls (test preparation, approval, performance and evaluation) for the 10 CFR 50, Appendix J, LLRT Option B and the ASME Section XI valve leak rate tests. The project team reviewed and determined that the parameters monitored and inspected under this program are in accordance with applicable the 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 states that the primary containment inspection, as implemented by OPT-20-5.1 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, Subsections IWE and IWL programs (BSEP LRA B.2.18 and 19, respectively). The project team reviewed OPT-20.5 and determined that Section 7.3, Engineering Prerequisites, specifies the primary containment inspection (performed per OPT 20.5-1) before ILRT performance. The project team reviewed and determined that the containment testing performed under this program, in conjunction with ASME Section XI, Subsections IWE and IWL, provides a program for the detection of aging effects in accordance with the GALL Report requirements.

For Option B testing, which is used at BSEP, the interval for testing may be increased on the basis of acceptable performance in meeting leakage limits in prior tests. The applicant states that guidance from RG 1.163 and NEI 94-01 is used to determine the inspection intervals. The project team reviewed OENP-16.8 and determined that Section 3.2.10 directs the use of these guidance documents in establishing the ILRT test intervals. The project team also reviewed Technical Specification Section 5.5.12 for both units and found that it specifies when the tests shall be performed. The project teams 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 states that the BSEP Technical Specification, Section 5.5.12, identifies the primary containment leakage rate testing program and the leakage rate acceptance criteria. The applicant further states, in BSEP calculation BNP-LR-615, 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 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 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 Rev 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 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. For Unit 1, the performance of the next Type A tests will be performed no later than April 15, 2004 (previous test performed February 15, 1991). For Unit 2, the performance of the next Type A test will be performed no later than April 30, 2005 (previous test performed February 28, 1993).

The project team reviewed the technical specifications for both units and determined that the above modifications are as specified for both units.

The project team reviewed those portions of the BSEP AMP B.2.21, “10 CFR Part 50, Appendix J Program," which the applicant claims is consistent with GALL AMP Section XI.S4, “10 CFR Part 50, Appendix J," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.20.3 Exceptions to the GALL Report

None

2.20.4 Enhancements

None

2.20.5 Operating Experience

The applicant states, in the BSEP LRA, that the 10 CFR Part 50, Appendix J program is maintained in accordance with BSEP engineering program requirements. This provides assurance that the program is effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews.

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 managing aging associaated with the structural integrity and leak tightness of the BSEP containment.

The applicant states, in BSEP calculation BNP-LR-615, that the results of operating experience for this program are contained in BSEP calculation BNP-LR-011. The purpose of this latter calculation is 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 concludes: 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 project team 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 project team 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.

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 project team concludes that the applicant's BSEP AMP B.2.21 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.20.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the 10 CFR Part 50, Appendix J program in the BSEP LRA, Appendix A, Section A.1.1.21, which states that the 10 CFR Part 50, Appendix J Program consists of monitoring of leakage rates through containment liner/welds, penetrations, fittings, and access openings to detect degradation of the pressure boundary. Corrective actions are taken if leakage rates exceed acceptance criteria. This program is implemented in accordance with Option B (performance based leak testing) of 10 CFR Part 50, Appendix J; Regulatory Guide 1.163; and NEI 94-01, "Industry Guideline for Implementing Performance Based Option of 10 CFR Part 50, Appendix J." The program is consistent with the corresponding program described in The GALL Report.

The project team reviewed the UFSAR Supplement for BSEP AMP B.2.21, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.20.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.21 MASONRY WALL PROGRAM (BSEP AMP B.2.22)

In BSEP LRA, Appendix B, Section B.2.22, the applicant states that BSEP AMP B.2.22, "Masonry Wall Program," is an existing plant program that will be consistent with GALL AMP XI.S5, "Masonry Wall Program," with an enhancement.

2.21.1 Program Description

The applicant states, in the BSEP LRA, 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 being in proximity or, or having attachments to, safety related 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.

2.21.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.22 will be consistent with GALL AMP XI.S5, with an enhancement.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.22, including BSEP calculation BNP-LR-662, “Masonry Wall Program,” Revision 0, which provides an assessment of the AMP’s consistency with AMP XI.S5 in the GALL Report. The project team also reviewed BSEP plant procedure, CAP-NGGC-0202, “Operating Experience Program,” Revision 8.

The project team reviewed those portions of the BSEP AMP B.2.22, “Masonry Wall Program," which the applicant claims is consistent with GALL AMP XI.S5, “Masonry Wall Program," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.21.3 Exceptions to the GALL Report

None

2.21.4 Enhancements

In the BSEP LRA, the applicant states the enhancements to this program to meet the GALL Report elements:

[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 ft of wall penetrations or of floor, ceiling, or lateral support connections” when assuring the absence of cracks.

The project team reviewed and 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 that basis, the project team reviewed and determined that this enhancement is 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 enhancement, and discussions with the applicant’s technical staff, the project team concluded that the enhancement stated by the applicant for

BSEP AMP B.2.22 to make it consistent with the program elements for GALL AMP XI.MS5 is acceptable.

2.21.5 Operating Experience

The project team reviewed operating experience of the applicant's masonry wall program. The applicant states, in the BSEP LRA, that the masonry wall program has provided for the detection of cracks and other minor aging effects in masonry walls which, when identified, are dispositioned in accordance with the applicant's corrective action process to ensure that the program, as implemented, is consistent with the BSEP design basis. 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, "Masonry Wall Design." The reevaluation was implemented in strict compliance with Bulletin 80-11 and resulted in a scope expansion from 86 safety related masonry walls in the original response to 153 safety related walls. Structural monitoring programs are continually being upgraded based upon industry and Nuclear Generation Group (NGG) 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 project team asked the applicant how operating experience is captured. The applicant indicated that plant procedure, CAP-NGGC-0202, "Operating Experience Program," is used to increase personnel's awareness of plant and industrial operating experience so that lesson learned can be used to adjust its aging management program, as necessary. In its procedure, the applicant states that it provides guidance for using, sharing, and evaluating operating experience at NGG sites as well as promote the identification and transfer lesson learned from industry. The project team 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 project team concludes that the applicant's BSEP AMP B.2.22 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.21.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the inspection of the masonry wall program in the BSEP LRA, Appendix A, Section A.1.1.22, which states that the program consists of inspections, based in NRC IE Bulletin 80-1, "Masonry Wall Design," for managing cracking of masonry walls. The program manages the aging effects of cracking for masonry walls within the service water building, reactor building, augmented off-gas building, diesel generator building, control building, and turbine building. The program is a condition monitoring program with inspection frequencies established such that no loss of intended function would occur between inspections.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.22, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.21.7 Conclusion

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

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

## 2.22 STRUCTURES MONITORING PROGRAM (BSEP AMP B.2.23)

In BSEP LRA, Appendix B, Section B.2.23 the applicant states that BSEP AMP B.2.23, "Structure Monitoring Program," is an existing plant program that will be consistent with GALL AMP XI.S6, "Structures Monitoring Program," with enhancements.

### 2.22.1 Program Description

The applicant states, in the BSEP LRA, 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 Maintenance Rule, 10 CFR50.65; NRC Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Rev. 2, and NEI (NUMARC) 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Rev. 2. The applicant also states 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 ACI 349.3R-96, "Evaluation of Existing Nuclear Safety-Related Concrete Structures;" and 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.

### 2.22.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.23 will be consistent with GALL AMP XI.S6, with enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.23, including BSEP calculation BNP-LR-608, "License Renewal Aging Management Program Description of the Structures Monitoring Program", Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.S6.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.23 and associated bases documents against the GALL AMP XI.S6 for consistency.

During the audit and review the project team noted that BSEP LRA Appendix B, Table B-1, indicates that GALL AMP XI.S7 is not credited for aging management of water control structures. The project team 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, in its preliminary response, stated:

> The CLB for BSEP does not credit R.G. 1.127 (XI.S7); the service water building is managed by the Maintenance Rule procedure "Condition Monitoring of Structures". The Condition Monitoring of Structures procedure is the primary implementing procedure for the SMP (Structures Monitoring Program). The SMP is credited for the management of all other structures at BSEP and has been 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 NUREG-1801 for material, environment, and aging effect, but a different AMP is credited). Note: R.G. 1.127 is primarily utilized for management of dams and given that BSEP has an established history with an effective management program, reconciliation to R.G. 1.127 does not appear appropriate.

As follow-up to the applicant's initial response, the project team 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.

In its letter dated March 14, 2005 (ML050810493), the applicant stated:

> (1) Intake Canal (including sheet-pile cellular bulkhead surrounding the Service Water Intake Structure) and the Service Water Intake Structure.
>
> (2) Both structures are managed by the Structures Monitoring Program.
>
> (3) 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 (5) years and, based on a comparison, the BSEP 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. The Structures Monitoring Program specifies an inspection frequency commensurate with the safety significance of the structure and its condition, but shall not exceed ten (10) years; RG 1.127 specifies an inspection frequency not to exceed five (5) years. The Structures Monitoring Program shall be enhanced to change the inspection frequency for the Service Water Intake Structure to not exceed five (5) years.

As documented below, in response to a project team question, the applicant also committed to enhance the structures monitoring program to inspect the submerged portions of the service water intake structure at least once every five (5) years.

In consideration of the applicant's commitment to inspect the service water intake structure (including submerged portions), intake canal and steel piles at least once every five (5) years, and the project team's comparison of program elements, the project team 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.

The project team reviewed those portions of the BSEP AMP B.2.23, "Structure Monitoring Program," which the applicant claims is consistent with GALL AMP XI.S6, "Structures Monitoring Program," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.22.3 Exceptions to the GALL Report

None

2.22.4 Enhancements

In Section B.2.23 of the BSEP LRA, the applicant states 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 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.

The project team asked the applicant to define the commodities, structures, and structural components currently in the scope of AMP B.2.23. The applicant stated that the subject components are identified in Chapter 3, Table 3.5.2-1 through 15 of the BSEP LRA. The project team also noted that the basis document (BNP-LR-608, Revision 1) identifies an enhancement to "Revise EGR-NGGC-0351 to specifically include all systems that credit the program for aging management." The project team reviewed the referenced BSEP LRA tables, and concluded that the applicant has identified the commodities, structures, and structural components that credit AMP B.2.23 for aging management.

On this basis, the project team reviewed and 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), 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.

The project team reviewed the applicant's references to the structures monitoring program in the AMR results for structures (BSEP LRA Section 3.5), and found them to be consistent with the above-listed enhancements to parameters monitored/inspected.

During the audit and review the project team noted that inspection of below-grade concrete, when exposed by excavation, and periodic monitoring of ground water to ensure it remains nonaggressive, are the key elements identified in the GALL Report for managing aging of below-grade concrete exposed to groundwater. However, the project team 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 project team requested that the applicant confirm that periodic monitoring of groundwater for aggressiveness will be conducted under BSEP AMP B.2.23 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 project team 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 recommendations in the GALL Report.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that periodic groundwater monitoring is currently being performed under Section 10.7 of implementing procedure 0E&RC-3250 and will be continued during the period of extended operation. An enhancement to the Structures Monitoring Program implementing procedure EGR-NGGC-0351 will be performed prior to the period of extended operation that requires the structures system engineer to review the groundwater monitoring results (from 0E&RC-3250) against the applicable parameters for determination of an aggressive below grade environment.

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 recommendations in GALL. The measured values for pH, chlorides and sulphates 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 0.12ppm. The project team noted that the GALL Report does not identify phosphates as an aggressive groundwater chemical, and sets no limits. The ACRS has raised questions concerning phosphate levels in groundwater; however, the staff's review of this issue did not result in any new requirements.

The project team noted that the SMP 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 project team asked the applicant to identify the frequency for periodic groundwater monitoring to ensure non-aggressiveness, and, if greater than annually, to explain the technical basis for the selected frequency.

The applicant stated that the SMP 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 project team reviewed and 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. See Section 2.22.6 below.

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 System Engineer training materials to include the procedure regarding condition monitoring of structures as a procedure requiring In-depth knowledge.

The project team reviewed and 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 above enhancements, the applicant's responses to audit questions, and discussions with the applicant's technical staff, the project team concluded that

the enhancements stated by the applicant for BSEP AMP B.2.23 to make it consistent with the program elements for GALL AMP XI.S6 are acceptable.

2.22.5 Operating Experience

The applicant states, in the BSEP LRA, that the structures monitoring program incorporates best practices recommended by the Institute of Nuclear Power Operations (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 on an annual frequency 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.

At the request of the project team, 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.

The project team requested the applicant to provide a summary of operating experience for: (1) submerged regions of the Units 1 and 2 service water buildings; and, (2) the intake canal and sheet piles.

During the audit and review 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 and 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 the 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% 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 project team asked the applicant whether the diver 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 AMP.

In its response, the applicant stated that:

> (1) 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
>
> (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 SMP 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 industry and plant-specific operating experience and on discussions with the applicant's technical staff, the project team concludes that the applicant's BSEP AMP B.2.23 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.22.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the inspection of the structures monitoring program in the BSEP LRA, Appendix A, Section A.1.1.23, which states:

> The Structures Monitoring 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. This program is implemented in accordance with Maintenance Rule, 10 CFR50.65; NEI (NUMARC) 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Rev. 2, and Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Rev. 2. The inspection criteria are based on ACI 349.3R-96, "Evaluation of Existing Nuclear Safety-Related Concrete Structures;" and ASCE 11-90, "Guideline for Structural Condition Assessment of Existing Buildings;" as well as, INPO Good Practice document 85-033, "Use of System Engineers;" and NEI 96-03, "Guidelines for Monitoring the Condition of Structures at Nuclear Plants."
>
> Prior to the period of extended operation, the Structures Monitoring Program will be enhanced to: (1) identify license renewal systems managed by the program and inspection boundaries between structures and systems; (2) require notification of the responsible engineer regarding availability of exposed below-grade concrete for inspection and require that an inspection be performed; (3) identify specific license renewal commodities and inspection attributes; (4) require a responsible engineer review of groundwater monitoring results; (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) improve training of system engineers in condition monitoring of structures. Following enhancement, the Structures Monitoring Program will be consistent with the corresponding program described in NUREG-1801.

Based on its responses to project team questions, the applicant has also committed to inspect the service water intake structure (including submerged portions), intake canal, and steel piles at least once every five (5) years, in order to be consistent with GALL AMP XI.S7 for water control structures; and to specify an annual frequency for groundwater monitoring in the implementing procedures for the structures monitoring program.

In a revised response (letter dated March 14, 2005, ML050810493) to a project team question, the applicant included the following revision to the UFSAR Supplement, Appendix A, Section A.1.1.23, second paragraph, in order to document these additional commitments:

> Prior to the period of extended operation, the Structures Monitoring Program will be enhanced to: (1) identify License Renewal systems managed by the Program and inspection boundaries between structures and systems, (2) require notification of the responsible engineer regarding availability of exposed below-grade concrete for inspection and require that an inspection be performed, (3) identify specific license renewal commodities and inspection attributes, (4) require responsible engineer review of groundwater monitoring results, (5) specify that an increase in sample size for component supports shall be implemented (rather than should be) commensurate with the degradation mechanisms found, (6) improve training of System Engineers in condition monitoring of structures, (7) include inspections of the submerged portions of the Service Water Intake Structure on a frequency not to exceed five years, (8) specify an annual groundwater monitoring inspection frequency for concrete structures, and (9) specify the inspection frequency for the Service Water Intake Structure and Intake Canal to not exceed five years. Following enhancement, the Structures Monitoring Program will be consistent with the corresponding program described in NUREG-1801.

The project team reviewed the revised UFSAR supplement for AMP B.2.23, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.22.7 Conclusion

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

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

## 2.23 PROTECTIVE COATING MONITORING AND MAINTENANCE PROGRAM (BSEP AMP B.2.24)

In BSEP LRA, Appendix B, Section B.2.24 , the applicant states that BSEP AMP B.2.24," Protective Coating Monitoring and Maintenance Program," is an existing plant program that will be consistent with GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program," with an exception and enhancements. The containment sump strainers are the only components in the plant that credit the protective coating monitoring and maintenance program as an aging management program.

### 2.23.1 Program Description

The applicant states, in the BSEP LRA, 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 emergency core cooling system (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 refurbishment 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.

### 2.23.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.24 will be consistent with GALL AMP XI.S8, with an exception and enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.24, including BSEP calculation BNP-LR-637, "License Renewal Aging Management Program Description of the Protective Coating Monitoring and Maintenance Program," July 8, 2004, which provides an assessment of the AMP elements' consistency with GALL AMP XI.S8.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.24 and associated bases documents against the GALL AMP XI.S8 for consistency.

In BSEP calculation BNP-LR-637, the applicant states that its protective coating monitoring and maintenance program is based upon a commitment to meet the requirements of Regulatory Guide 1.54, "Quality Assurance Requirements for Protective coatings Applied to Water-Controlled Nuclear Power Plants," Rev. 0, issued June 1973. The GALL Report states that a comparable program for monitoring and maintaining protective coatings inside containment, developed in accordance with Regulatory Guide 1.54, Rev. 0, is also acceptable as an aging management program for license renewal. Therefore, the project team reviewed and

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.

In BSEP Procedure OMISCEL-1027, "RHR/CS Strainer Debris Head Loss Analysis Post LOCA," 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 project team 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. The project team asked the applicant what other programs are credited for other types of debris.

In its letter dated March 14, 2005 (ML050810493), the applicant stated 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 project team reviewed the applicants response and determined that the applicant has identified those BSEP AMPs that manage aging effects that may contribute to the debris inside the primary containment.

During the audit and review the project team reviewed those portions of the BSEP AMP B.2.24," Protective Coating Monitoring and Maintenance Program," which the applicant claims is consistent with GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.23.3 Exceptions to the GALL Report

In the BSEP LRA, Appendix B, Section B.2.24, the applicant states the following exception to the GALL Report elements.

[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 program is not credited within the license renewal review for prevention of corrosion of carbon steel.

The project team reviewed the associated aging management reviews in the BSEP LRA. The containment sump strainers are the only components in the plant that credit the protective coating monitoring and maintenance program as an aging management program. The degradation of the carbon steel components, which have applied coatings, is managed by other aging management programs, such as the water chemistry, ASME Section XI inservice inspections, one-time inspections, system monitoring, preventive maintenance, above-ground steel tanks, and open-cycle cooling water system programs. The project team reviewed and determined that not crediting the protective coating monitoring 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 aging management programs.

On the basis of its review of the above exception, and discussions with the applicant's technical staff, the project team concluded that the exception stated by the applicant for BSEP AMP B.2.24 to the program elements for AMP XI.S8 in the GALL Report is acceptable.

2.23.4 Enhancements

In the BSEP LRA, the applicant states 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."

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 project team reviewed and 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 project team reviewed and determined that these enhancement are acceptable.

Enhancement 2

[Acceptance Criteria] The GALL Report identifies the following evaluation and technical basis for the acceptance 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.

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 project team reviewed and 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 project team reviewed and 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 project team concluded that the enhancements stated by the applicant for BSEP AMP B.2.24 to make it consistent with the program elements for GALL AMP XI.S8 are acceptable.

2.23.5 Operating Experience

The applicant states, in the BSEP LRA, that the BSEP response to NRC GL 98-04 described how the Protective Coating Monitoring Program complies with Regulatory Guide 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 states that Service Level I protective coatings were determined to be within the scope of 10 CFR 50.65, the Maintenance Rule, and a maintenance rule 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.

In calculation BNP-LR-637, the applicant states 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 BSEP 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 maintenance rule 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, an autochthonal item was assigned to the program manager to develop 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 on discussions with the applicant's technical staff, the project team concludes that the applicant's BSEP AMP B.2.24 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.23.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the protective coating monitoring and maintenance program in the BSEP LRA, Appendix A, Section A.1.1.24, which states that prior to the period of extended operation, the program administrative controls will be enhanced to:

(1) 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; (2) add a requirement for a detailed, focused inspection of areas noted as deficient during the general inspection; (3) 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;” and, (4) document the results of inspections and compare the results to previous inspection results and to acceptance criteria. Following enhancement, the program will be consistent with the corresponding program described in the GALL Report.

The project team reviewed the UFSAR supplement for BSEP AMP B.2.24, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.23.7 Conclusion

On the basis of its review and audit of the applicant’s program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team has reviewed the enhancements and determined that the implementation of the enhancements prior to the period of extended operation would result in the existing aging management program being consistent with the GALL program to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.24 ELECTRICAL CABLES AND CONNECTIONS NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS PROGRAM (BSEP AMP B.2.25)

In BSEP LRA, Appendix B, Section B.2.25, the applicant states that BSEP AMP B.2.25, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," is a new program that is consistent with GALL AMP XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.”

2.24.1 Program Description

The applicant states, in the BSEP LRA, that this program is credited for aging management of cables and connections not included in the BSEP EQ program. In addition, the applicant states 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.

2.24.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.2.25 is consistent with the GALL AMP XI.E1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.25, including calculation BNP-LR-664, “License Renewal Aging Management Program Description of the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," Rev. 1, which provides an assessment of AMP XI.E1 in the GALL report and BSEP plant procedure, CAP-NGGC-0202, “Operating Experience Program,” Revision 8.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.25 and associated bases documents against the GALL AMP XI.E1 for consistency.

The project team 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 project team 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.

During the audit and review the project team reviewed those portions of the BSEP AMP B.2.25, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," which the applicant claims is consistent with GALL AMP XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.24.3 Exceptions to the GALL Report

None

2.24.4 Enhancements

None

2.24.5 Operating Experience

In the BSEP LRA, the applicant states 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 NUREG-1801, 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.

The project team asked the applicant how operating experience is captured. The applicant

indicated that plant procedure, CAP-NGGC-0202, “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 aging management program, as necessary. In its procedure, the applicant states that it provides guidance for using, sharing, and evaluating operating experience at Nuclear Generation Group (NGG) sites as well as promote the identification and transfer lesson learned from industry. The project team 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 project team concludes that the applicant’s BSEP AMP B.2.25 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.24.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the electrical cables and connections not subject to 10 CFR 50.49 environmental qualification requirements program in the BSEP LRA, Appendix A, Section A.1.1.25, which states that the electrical cables and connections not subject to 10 CFR 50.49 environmental qualification requirements program is credited for aging management of cables and connections not included in the BSEP Environmental qualification (EQ) Program. Under this program, 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, such as embrittlement, discoloration, cracking, swelling, or surface contamination, which are precursor indications of conductor insulation aging degradation from heat, radiation, or moisture. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service condition for the electrical cable or connection. This program is consistent with the corresponding program described in NUREG-1801.

The project team reviewed the UFSAR Supplement for BSEP AMP B.2.25, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.24.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.25 ELECTRICAL CABLES NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS USED IN INSTRUMENTATION CIRCUITS PROGRAM (BSEP AMP B.2.26)

In BSEP LRA, Appendix B, Section B.2.26 , the applicant states that BSEP AMP B.2.26, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used

in Instrumentation Circuits Program," is a new program that is consistent with GALL AMP XI.E2, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits ," with an exception.

2.25.1 Program Description

The applicant states, in the BSEP LRA, 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). A reduction in IR is a concern for circuits with sensitive, high voltage, low-level signal 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.

2.25.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.2.26 is consistent with GALL AMP XI.E2, with an exception.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.26, including Nuclear Generation Group, BNP-LR-655, “License Renewal Aging Management Program Description of the Electrical Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program," Revision 0, which provides an assessment of the AMP elements' consistency with GALL AMP XI.E2 and BSEP plant procedure, CAP-NGGC-0202, “Operating Experience Program,” Revision 8.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.26 and associated bases documents against the GALL AMP XI.E2 for consistency.

In its basis documentation, BNP-LR-655, the applicant states 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 NRC staff’s proposed Interim Staff Guidance (ISG)-15, Revision of Generic Aging Lesson Learned (GALL) Aging Management Program XI.E2, “Electrical Cables not Subject to 10 CFR 50.49 Environment Qualification Requirement Used in Instrumentation Circuits.”

During the audit, the project team noted that the basis documentation for BSEP AMP B.2.26: (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 the 10-year testing frequency for the neutron flux monitoring instrumentation circuits cable systems.

In response to project team questions, by letter dated March 14, 2005 (ML050810493), the applicant stated that it will revise the BSEP AMP B.2.26 basis documentation and the BSEP LRA accordingly to:

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 project team reviewed the applicant's responses and, on the basis that these changes are consistent with ISG-15, the project team reviewed and determined that the applicant's responses are acceptable.

The project team reviewed those portions of the BSEP AMP B.2.26, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program," which the applicant claims is consistent with GALL AMP XI.E2, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits ," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.25.3 Exception to the GALL Report

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

[Parameters Monitored/Inspected, Detection of Aging Effects, and Acceptance Criteria] The GALL Report identifies the following recommendations 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 BSEP LRA, the applicant states that direct cable testing will be performed as an alternative to instrument loop calibrations for neutron flux monitoring instrumentation circuits. The project team 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 environmental qualification requirements used in instrumentation circuits.

On the basis of its review of the above exceptions, the project team concluded that the exceptions stated by the applicant for BSEP AMP B.2.26 to the program elements for GALL AMP XI.E2 are acceptable.

2.25.4 Enhancements

None

2.25.5 Operating Experience

The applicant states, in the BSEP LRA, that 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 NUREG-1801, 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.

During the audit and review the project team asked the applicant how operating experience is captured. The applicant indicated that plant procedure, CAP-NGGC-0202, "Operating Experience Program," is used to increase personnel's awareness of plant and industrial operating experience so that lesson learned can be used to adjust its aging management program, as necessary. In its procedure, the applicant states that it provides guidance for using, sharing, and evaluating operating experience at Nuclear Generation Group (NGG) sites as well as promote the identification and transfer lesson learned from industry. The project team 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 project team concludes that the applicant's BSEP AMP B.2.26 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.25.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the electrical cables not subject to 10 CFR 50.49 environmental qualification requirements used in instrumentation circuits program in the BSEP LRA, Appendix A, Section A.1.1.26, which states that 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.

In its letter dated March 14, 2005 (ML050810493), the applicant provided the following revised UFSAR supplement:

> 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 project team reviewed and determined that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.25.7 Conclusion.

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.26 INACCESSIBLE MEDIUM-VOLTAGE CABLES NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS PROGRAM (BSEP AMP B.2.27)

In BSEP LRA, Appendix B, Section B.2.27, the applicant states that BSEP AMP B.2.27, "Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," 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.”

### 2.26.1 Program Description

In the BSEP LRA, the applicant states that the inaccessible medium-voltage cables not subject to 10 CFR 50.49 environmental qualification requirements program is credited for managing the aging cables that are not included in the BSEP 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, or 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% 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).

### 2.26.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.2.27 is consistent with the GALL AMP XI.E3.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.27, including BSEP calculation No. BNP-LR-666,"License Renewal Aging Management Program Description of the Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program,” Rev. 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.E3. The project team also reviewed BSEP plant procedure, CAP-NGGC-0202, “Operating Experience Program,” Revision 8.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.2.27 and associated bases documents against the GALL AMP XI.E3 for consistency.

In its basis documentation, BNP-LR-666, the applicant states that no preventive actions are required as part of BSEP AMP B.2.27. Periodic actions may be taken to prevent non-EQ medium-voltage cables from being exposed to significant moisture. In addition, the applicant states that medium-voltage cables for which such actions are taken are not required to be tested.

The project team noted that periodic actions should be taken to minimize cables from being exposed 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 project team 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.

In its letter dated March 14, 2005 (ML050810493), the applicant provided its formal response, in which it stated that:

> In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested at least once every 10 years as stated in Section A.1.1.27, of Appendix A and Section B.2.27 of Appendix B of the BSEP LRA. This frequency is consistent with that recommended in Section XI.E3 of NUREG-1801.
>
> The medium-voltage License Renewal manholes will be inspected and accumulated water will be removed by the Preventive Maintenance Program. The inspection frequency will be based on actual field data and shall not exceed two years.

The project team 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.

The project team reviewed those portions of the BSEP AMP B.2.27, "Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," which the applicant claims is consistent with GALL AMP XI.E3, "Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.26.3 Exceptions to the GALL Report

None

2.26.4 Enhancements

None

2.26.5 Operating Experience

The applicant states, in the BSEP LRA, 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 NUREG-1801, industry operating experience has shown that 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 and review the project team asked the applicant how operating experience is captured. The applicant indicated that plant procedure, CAP-NGGC-0202, "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 aging management program, as necessary. In its procedure, the applicant states that it provides guidance for using, sharing, and evaluating operating experience at Nuclear Generation Group (NGG) sites, as well as promoting the identification and transfer of lessons learned by the industry. The project team 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 project team concludes that the applicant's BSEP AMP B.2.27 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.26.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the inaccessible medium-voltage cables not subject to 10 CFR 50.49 environmental qualification requirements program in the BSEP LRA, Appendix A, Section A.1.1.27, which describes the program scope.

In its letter dated March 14, 2005 (ML050810493), the applicant provided the following revision to the UFSAR supplement, as part of its response to question B.2.27-1:

> 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 BSEP 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, or 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% of the time. The moisture and voltage exposures described as significant in these definitions are not significant for medium-voltage cables that are designed for these conditions (e.g., continuous wetting and continuous energization are not significant for submarine cables).
>
> Manholes associated with inaccessible non-EQ medium-voltage cables will be inspected for water accumulation and drained, as needed. The manhole inspection frequency will be based on actual field data and shall not exceed two years. This program is consistent with the corresponding program description in NUREG-1801.

The project team reviewed the revised UFSAR supplement for BSEP AMP B.2.27, found that it is consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.26.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.27 PREVENTIVE MAINTENANCE PROGRAM (BSEP AMP B.2.30)

In BSEP LRA, Appendix B, Section B.2.30, the applicant describes BSEP AMP B.2.30 "Preventive Maintenance Program."

The applicant states that BSEP AMP B.2.30 is an existing, plant-specific program.

The project team reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.2.30, including BSEP calculation No. BNP-LR-642, "License Renewal Aging Management Program Description of the Preventive Maintenance Program," Revision 1, September 20, 2004, and interviewed the applicant's technical staff.

### 2.27.1 Review of the AMP Against the Program Elements

The project team reviewed BSEP AMP B.2.30 against the AMP elements found in the SRP-LR, Appendix A.1, Section A.1.2.3 and SRP-LR Table A.1-1. The project team followed the reviewed process as described in the BSEP audit and review plan.

#### 2.27.1.1 Scope of Program

The "scope of program" program element criterion in Appendix A.1.2.3.1 of the SRP-LR requires that the program scope include the specific structures and components addressed with this program.

Appendix A.1.2.3.1 of the SRP-LR for the "scope of program" element states the following:

> The specific program necessary for license renewal should be identified. The scope of the program should include the specific structures and components being managed by the AMP.

The applicant stated in BSEP AMP B.2.30 , for the "scope of program" program element that this program is a plant-specific program that assures various aging effects are managed for a wide range of components, as specified by aging management reviews and credited in select aging management programs.

In BSEP LRA Appendix B, Section B.2.30, the applicant provides a table that summarizes the activities for the systems that are within the scope of the PM program. The table includes the components that credit the PM program for management of specific aging effects. In particular, the program provides for periodic component replacement/refurbishment, inspection, and testing of components. The PM program may also be used to implement specific preventive maintenance activities required by other aging management programs. The applicant will add or modify PM program activities, as necessary, to assure that age-related degradation will be

managed for the systems/components for which the program is credited.

In BSEP calculation BNP-LR-642, the applicant provides a list of the systems, component/ commodity groups, intended functions, and aging effects/mechanisms managed by this program. The calculation also contains a list of the materials of construction for the component groups in the scope of the PM program and the environments to which the component groups are exposed.

In calculation BNP-LR-642, the applicant identifies the procedures that procedurally control the PM program. Plant operating procedures, engineering evaluation reports, work order packages, and the PassPort database contain the details concerning the inspection requirements, scheduling intervals, criteria, and documentation and review of results.

In the BSEP LRA, the applicant states that the preventive maintenance (PM) program provides for inspections of structures and components, or their replacement/refurbishment, during the performance of preventive maintenance activities. The program assures that various aging effects are managed for a wide range of components through scheduled inspections and predetermined criteria.

The PM program includes inspections for blockage of flow, internal corrosion, fouling of heat exchangers, cracking, loss of material, loss of heat transfer, degradation of elastomers, and adverse impact on the function of nearby safety-related components. The components inspected or replaced as part of the preventive maintenance program include heat exchanges, relief valves, strainers, filters, traps, sump pumps, rubber bladders, elastomer seals, and plate coils in containment penetrations.

The program administrative controls reference activities for monitoring structures, systems, and components to permit early detection of degradation. Data from walk-downs is trended and evaluated to identify and correct problems. In addition, the program includes periodic refurbishment or replacement of structures and components.

The applicant credits the PM program for the aging management of selected components in the following systems:

- Residual Heat Removal System
- High Pressure Coolant Injection System
- Standby Liquid Control System
- Reactor Building Closed Cooling Water System
- DG Fuel Oil System
- DG Lube Oil System
- DG Jacket Water System
- DG Starting Air System
- Standby Gas Treatment System
- HVAC Diesel Generator Building
- HVAC Reactor Building
- HVAC Control Building
- Service Water Intake Structure
- Diesel Generator Building
- Control Building

The project team determined that the specific components for which the program manages aging effects are identified, which satisfies the criterion defined in Appendix A.1.2.3.1 of the SRP-LR. On this basis, the project team finds that the applicant's scope of program acceptable.

2.27.1.2 Preventive Actions

The “preventive actions” program element criterion in Appendix A.1.2.3.2 of the SRP-LR is that condition monitoring programs do not rely on preventive actions, and thus, preventive actions need not be provided.

The guidance provided in Appendix A.1.2.3.2 of the SRP-LR for the “preventive actions” program element states the following:

> The activities for prevention and mitigation programs should be described. These actions should mitigate or prevent aging degradations.
>
> For condition or performance monitoring programs, they do not rely on preventive actions and thus, preventive actions this information need not be provided. More than one type of aging management program may be implemented to ensure that aging effects are managed.

The applicant states in BSEP AMP B.2.30 for the "preventive actions" program element, that this program includes periodic refurbishment or replacement of components specified at an interval that assures no loss of intended function.

The project team reviewed calculation BNP-LR-642, which confirms that, where appropriate, the PM program contains inspections and testing activities used to identify component aging degradation effects.

The project team determined that the preventive actions program element satisfies the criterion defined in Appendix A.1.2.3.2 of the SRP-LR. Based on a review of selected documents that implement the PM program and on discussions with the applicant’s technical staff, the project team reviewed and determined that the PM program consists of preventive and mitigation programs, and performance monitoring programs that satisfy the guidance provided in Appendix A.1.2.3.2 of the SRP-LR. On this basis, the project team finds that the applicant's preventive actions acceptable.

2.27.1.3 Parameters Monitored/Inspected

The “parameters monitored or inspected” program element criteria in Appendix A.1.2.3.3 of the SRP-LR are:

> The parameters to be monitored or inspected should be identified and linked to the degradation of the particular structure and component intended function(s).
>
> The parameter monitored or inspected should detect the presence and extent of aging effects.
>
> For a performance monitoring program, a link should be established between the degradation of the particular structure or component intended function(s) and the

parameter(s) being monitored. A performance monitoring program may not ensure the structure and component intended function(s) without linking the degradation of passive intended functions with the performance being monitored.

The applicant states in BSEP AMP B.2.30, for the "parameters monitored or inspected" program element, that this program consists of inspections, testing, and criteria used to identify component aging effects. Where necessary, activities are specified on a component-specific basis to ensure that appropriate parameters are monitored based on anticipated aging effects.

In BSEP LRA, Appendix B, Section B.2.30, the applicant identifies the inspection activities that monitor various parameters, such as surface condition, loss of material, corrosion, cracking, elastomer degradation, loss of heat transfer effectiveness, and adverse impacts on nearby safety-related components. In addition, the aging effects and mechanisms to be managed by the PM program are detailed in calculation BNP-LR-642, Attachment 1.

The project team observed that examples of aging effects monitored by the PM program include visual inspections of the interior of the stand-by liquid control (SLC) system accumulator shells to identify corrosion, measurements of flow in HPIC minimum flow bypass lines to identify clogging, and visual examinations of elastomers for cracking to identify aging degradations, such as cracking.

In BSEP LRA Appendix B, Section B.2.30, the applicant stated an enhancement to their existing program that will add or modify PM program activities, as necessary, to assure that age-related degradation will be managed for the components that credit the program. The applicant will complete these additions and modifications prior to the period of extended operations. For example, in BSEP calculation BNP-LR-642, the applicant states that PM programs shall be created to insure structures and components will not adversely impact the function of nearby safety-related components. Examples of the additional structures and components include the service water building, circulating water intake structure sump pumps, and diesel generator building sump pumps.

The project team determined that the preventive actions program element satisfies the criterion defined in Appendix A.1.2.3.3 of the SRP-LR. Based on a review of implementing documents, the project team reviewed and determined that the parameters inspected by the PM program for passive long-lived components are adequate to provide symptomatic evidence of potential degradation for timely replacement of components to prevent equipment failure. The audit team also determined that the routinely scheduled replacement, or timely refurbishment of structures and components will maintain conditions such that their associated systems will be able to perform their intended functions during the period of intended operation. Therefore, the applicant’s preventive actions program element satisfies the guidance provided in Appendix A.1.2.3.3 of the SRP-LR. On this basis, the project team finds that the applicant's parameters monitored or inspected acceptable.

2.27.1.4 Detection of Aging Effects

The guidance provided in Appendix A.1.2.3.4 of the SRP-LR for the “detection of aging effects” program element states the following:

> Detection of aging effects should occur before there is a loss of the structure and component intended function(s). The parameters to be monitored or inspected should be appropriate to ensure that the structure and component intended functions(s) will be

adequately maintained for license renewal under all CLB design conditions. This includes aspects such as method or technique, frequency, sample size, data collection and timing of new/one-time inspections to ensure timely detection of aging effects. Provide information that links the parameter to be monitored or inspected to aging effects being managed.

The effects of aging on a structure or component should be managed to ensure its availability to perform its intended function(s) as designed when call upon. A program based solely on detecting structure and component failure should not be considered as an effective aging management program for license renewal.

The program element describes “when,” “where,” and “how” program data are collected.

The method or technique and frequency may be linked to plant-specific or industry-wide operating experience. Provide justification, including codes and standards referenced, that the technique and frequency are adequate to detect the aging effects before a loss of SC intended function. A program based solely on detecting SC failures is not considered an effective aging management program.

When sampling is used to inspect a group of SCs, provide the basis for the inspection population and sample size.

The applicant states in BSEP AMP B.2.30, for the "detection of aging effects" program element, that this program provides inspection and test criteria identified during the aging management reviews that rely on the program for detection of the aging effects.

During the audit and review the project team reviewed BSEP engineering procedure OENP-2704, work order packages, PassPort database system queries, and corrective action reports. The applicant uses a PassPort database to identify the frequency of preventive maintenance, and to generate work orders. The work orders contain the component, the parameter monitored or inspected, the degradation being monitored, the procedure to conduct the inspection, and what data to collect. The work order also identifies the codes and standards, if any, that are associated with the activity, the techniques to be used, and the qualification requirements for the inspectors.

The project team noted that the PM program activities include use of ultrasonic flow meters to confirm high pressure core injection (HPCI) minimum flow bypass valves are not excessively clogged, visual inspections of elastomers to detect aging degradation effects, such as cracking, and visual (VT-2) examinations of HPCI piping to identify corrosion.

The applicant states that the BSEP PM program is a defined scope program directed toward specified components. In systems where the scope is not defined at a component level (HVAC systems), inspection criteria will address representative or leading indicator conditions for the aging mechanism of concern. Degraded conditions would be addressed through the corrective action program, including expansion of inspections and repairs, as necessary.

The project team reviewed and determined that the work orders provided links between the parameters and the aging effects being monitored. The project team reviewed and determined that the techniques used to detect aging effects are consistent with accepted engineering practice and, therefore, satisfy this program element.

The project team determined that this program element satisfies the criteria defined in Appendix A.1.2.3.4 of the SRP-LR. On this basis, the project team finds that the applicant's detection of aging effects acceptable.

2.27.1.5 Monitoring and Trending

The “monitoring and trending” program element criteria in Appendix A Section A.1.2.3.5 of the SRP-LR are

> Monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions.
>
> This program element describes ‘how’ the data collected is evaluated and may also include trending for a forward look. The parameter or indicator trended should be described. The methodology for analyzing the inspection or test results against the acceptance criteria should be described.

The applicant states in BSEP AMP B.2.30, for the "monitoring and trending" program element, that this program states that inspection intervals are specified, as necessary, to ensure that aging effects are detected prior to loss of intended functions. Condition monitoring is accomplished by generic procedural requirements, as well as, specific requirements contained in preventive maintenance activities.

During the audit and review the project team reviewed procedures and held discussions with the applicant’s technical staff. The applicant uses the PassPort database to schedule and tract PM activities. Some work requests contain the acceptance criteria and the actions to be taken if the acceptance criteria are exceeded. In other cases, the work requests require the results of the monitoring or inspection activity be forwarded to the systems engineers for their review and action. The system engineers are responsible for reviewing and trending the results. The frequency of activities is adjusted by the system engineers on the basis of trending data from previous activities.

The project team reviewed and determined that the overall monitoring and trending techniques proposed by the applicant are acceptable on the basis that the inspections, replacements, and sampling activities described by the applicant will effectively manage the applicable aging effects.

The project team determines that for visual inspection, this program element satisfies the criteria defined in Appendix A.1.2.3.5 of the SRP-LR. On this basis, the project team finds that the applicant's monitoring and trending acceptable.

2.27.1.6 Acceptance Criteria

The “acceptance criteria” program element criteria in Appendix A.1.2.3.6 of the SRP-LR are

> The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the system and component (SC) intended function(s) are maintained under all CLB design conditions during the period of extended operation. The program should include a methodology for analyzing the results against applicable acceptance

criteria.

Acceptance criteria could be specific numerical values, or could consist of a discuss of the process fro calculating specific numerical values of conditional acceptance criteria to ensure that the structure and component intended function(s) will be maintained under all CLB design conditions. Information from available references may be cited.

It is not necessary to justify any acceptance criteria taken directly from the design basis information that is included in the FSAR because that is a part of the CLB. Also, it is not necessary to discuss CLB design loads if the acceptance criteria do not permit degradation because a structure and component without degradation should continue to function as originally designed. Acceptance criteria, which do permit degradation, are based on maintaining the intended function under all CLB design loads.

Quantitative inspections should be performed to same predetermined criteria as quantitative inspections by personnel in accordance with ASME Code and through approved site specific programs.

The applicant states in BSEP AMP B.2.30, for the "acceptance criteria" program element, that this program states that the acceptance criteria are specified based on generic requirements and application-specific considerations, and are intended to ensure that an acceptable level of performance is maintained at all times.

During the audit and review the project team reviewed and determined that this is acceptable on the basis that the plant design basis includes code-specified acceptance criteria for applicable systems.

The project team reviewed this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.6 of the SRP-LR. On this basis, the project team finds that the applicant's monitoring and trending acceptable.

2.27.1.7 Corrective Actions

This program element is reviewed by the NRR/DIPM staff and addressed in Section 3 of the SER related to the BSEP LRA.

2.27.1.8 Confirmation Process

This program element is reviewed by the NRR/DIPM staff and addressed in Section 3 of the SER related to the BSEP LRA.

2.27.1.9 Administrative Controls

This program element is reviewed by the NRR/DIPM staff and addressed in Section 3 of the SER related to the BSEP LRA.

2.27.1.10 Operating Experience

The “operating experience” program element criterion in Appendix A.1.2.3.10 of the SRP-LR states that operating experience 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.

The applicant states in the BSEP LRA Appendix B, Section B.2.30 for “operating experience” program element that operating experience has demonstrated that the PM program has been effective in maintaining component performance and function. The program is subject to continual improvement under corporate procedures and initiatives.

The project team reviewed the operating experience provided in the BSEP 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.

In BSEP calculation BNP-LR-642, the applicant states that The GALL Report is based on industry operating experience through April 2001. Recent industry operating experience has been reviewed for applicability, and subsequent operating experience will be captured through the normal operating experience review process.

Periodic surveillance and PM activities have been in place at BSEP since the plant began operation. These activities have proven effective at maintaining the material condition of systems, structures, and components and detecting unsatisfactory conditions. There is a demonstrated history of detecting damaged and degraded components and causing their repair or replacement in accordance with the site corrective action process.

The applicant performed a review of corrective actions for a ten-year period to investigate site operating experience relative to various aging management reviews performed in accordance with BSEP calculation EGR-NGGC-0504. These reviews revealed that the corrective action program had a limited number of corrective action reports identifying age-related degradation and failures. For those failures, corrective actions were taken that resulted in improvements to maintenance and operating procedures/practices, and prevented recurrence of the failures.

The project team reviewed the BSEP corrective action report EER-90-0102, which addressed degradation of the standby liquid control (SLC) system accumulators. In 1988, during an annual SLC accumulator bladder inspection, the applicant found surface corrosion on the interior shell of a SLC accumulator, and set up six month inspection intervals for the SLC accumulators. On the basis of inspection results, the applicant calculated a corrosion rate in 1990 and determined that the next surveillance of the accumulators would be due on Unit 1 prior to December 5, 1992, and on Unit 2 prior to March 31, 1993.

The project team reviewed selected corrective action reports and concluded that the applicant’s operating experience supports the conclusion that the program will adequately manage aging effects in the specified systems, structures, and components for which this program is credited.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant’s BSEP AMP B.2.30 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.27.2 UFSAR Supplement

The applicant provides its UFSAR Supplement for the PM program in the BSEP LRA, Appendix A, Section A.1.1.32, which states that:

The Preventive Maintenance (PM) Program assures that various aging effects are managed for a wide range of components. PM activities, including periodic component replacement, inspections, and testing, may be used to manage aging effects and mechanisms. The program uses scheduled inspections and predetermined criteria to ensure that aging effects are managed.

Prior to the period of extended operation, activities will be incorporated into the program, as needed, to satisfy aging management reviews of components that rely on the PM Program for management of aging effects.

The project team reviewed the UFSAR Supplement, found that it was consistent with the GALL Report, and determines that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.27.3 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team also finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.28 REACTOR COOLANT PRESSURE BOUNDARY FATIGUE MONITORING PROGRAM (BSEP AMP B.3.1)

In BSEP LRA, Appendix B, Section B.3.1, the applicant states that BSEP AMP B.3.1," Reactor Coolant Pressure Boundary Fatigue Monitoring Program," is an existing plant program that will be consistent with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary," with an exception and enhancements.

2.28.1 Program Description

The applicant states, in the BSEP LRA, 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 states that this program addresses the effects of the reactor coolant environment on component fatigue life by including, within the "program scope" 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.

2.28.2 Consistency with the GALL Report

In the BSEP LRA, the applicant states that BSEP AMP B.3.1 will be consistent with GALL AMP X.M1, with an exception and enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.3.1, including BSEP calculation BNP-LR-605, “License Renewal Aging Management Program Description of the Reactor Coolant Pressure Boundary Fatigue Monitoring Program," Revision 0, which provides an assessment of the AMP elements' consistency with GALL AMP X.M1.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.3.1 and associated bases documents against the GALL AMP X.M1 for consistency.

The project team reviewed those portions of the BSEP AMP B.3.1,” Reactor Coolant Pressure Boundary Fatigue Monitoring Program," which the applicant claims is consistent with GALL AMP X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.28.3 Exceptions to the GALL Report

In the BSEP LRA, Section B.3.1, the applicant states an exception to the program elements listed in the GALL AMP X.M1, as follows:

[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 cumulative usage factor (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 project team considered the applicant’s exception to be inconsistent with the GALL Report and requested that the applicant provide additional information to justify why all of the locations identified in NUREG/CR 6260 would not be included.

In its letter dated March 14, 2005 (ML050810493), the applicant provided its response, which stated:

> BSEP AMP B.3.1 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. This will eliminate the exception to GALL Report program element for Monitoring and Trending.

The project team reviewed and determined that the applicant’s commitment to remove this

exception to the GALL Report is acceptable because BSEP will include all locations that meet the original criteria, in addition to the 6 locations identified in NUREG/CR-6260. The applicant's revision to the AMP, to remove 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 6 locations which will be included regardless of the predicted CUF.

2.28.4 Enhancements

In the BSEP LRA, the applicant states 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 recommendations for the scope of 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.

The project team finds 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 2

[Preventive Actions] The GALL Report recommends the following recommendations 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 (RCPB) 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.

The project team 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 project team finds 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 (RCPB) 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.

In response to a project team question, the applicant has committed to include monitoring and trending of all sample locations identified in NUREG/CR-6260, independent of the 0.5 CUF selection criterion. The project team 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.

The project team finds 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.

2.28.5 Operating Experience

The applicant states, in the BSEP LRA, that a review was conducted of NRC Information Notices, Bulletins, and GLs for the years 2000 – 2004, but no applicable operating experience (OE) 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 reactor pressure vessel components remain below the design limit of 1.0, since the highest cumulative usage factor (CUF) value to-date 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 project team asked the applicant a number of questions to gain a better understanding of the applicant's implementation of the reactor coolant pressure boundary fatigue monitoring program, and related operating experience.

The project team 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 the actual transient occurrences on 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 is supplied to the Fatigue-Pro CEM program manually.

The project team asked when existing program was first implemented, whether any locations had been added or deleted and what 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 Table 4.3-2 of the BSEP LRA. The locations currently monitored are the refueling bellows support, reactor vessel head closure studs, recirculation inlet nozzles, core spray nozzles, and feedwater nozzles.

The project team asked the applicant to identify the specific paragraphs in the existing implementing procedure that will be revised to incorporate the listed enhancements. The applicant stated that the specific changes to be made to the implementing procedure have not yet been identified. The BSEP license renewal staff is currently developing detailed implementation plans.

The project team 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 Subsection 4.3.1 of the BSEP LRA, 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 GE in 1983. In the GE evaluation, it was 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 the plant operations from original plant startup through 1992 were used as input 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, Subsection 4.3.3 of the BSEP LRA provides a summary of the CUF analyses for these components.

The project team 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 > 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 BSEP LRA Tables 4.3-3 and 4.3-4. Each of the locations identified in NUREG/CR-6260 will be included in the fatigue monitoring program and will not be deleted based upon the CUF > 0.5 criterion.

The project team reviewed the applicant's responses and concluded that the existing BSEP fatigue monitoring program has been implemented in accordance with accepted technical practice for fatigue monitoring.

The project team reviewed the operating experience provided in BSEP 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 project team concludes that the applicant's BSEP AMP B.3.1 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.28.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the reactor coolant pressure boundary fatigue monitoring program in the BSEP LRA, Appendix A, Section A.1.1.28.

In its letter dated March 14, 2005 (ML050810493), as part of its response to a project team 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 project team reviewed the revised UFSAR supplement for BSEP AMP B.3.1, found that it is consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.28.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those

program elements for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the project team has 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 project team has reviewed the enhancements and determined that the implementation of the enhancements prior to the period of extended operation would result in the existing aging management program being consistent with the GALL program to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

2.29 ENVIRONMENTAL QUALIFICATION (EQ) PROGRAM (BSEP AMP B.3.2)

In BSEP LRA, Appendix B, Section B.3.2, the applicant states that BSEP AMP B.3.2, “Environmental Qualification (EQ) Program," is an existing plant program that is consistent with GALL AMP X.E1, “Environmental Qualification (EQ) of Electrical Components."

2.29.1 Program Description

The applicant states, in the BSEP LRA, that the EQ program manages component thermal, radiation, 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 considered time-limited aging analyses (TLAAs) for license renewal.

2.29.2 Consistency with the GALL Report

In BSEP LRA, the applicant states that BSEP AMP B.3.2 is consistent with the GALL AMP X.E1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for BSEP AMP B.3.2, including Nuclear Generation Group, BNP-LR-650," License Renewal Aging Management Program Description of the EQ Program,” Rev. 0, which provides an assessment of the AMP’s consistency with GALL AMP X.E1 and BSEP plant procedure, CAP-NGGC-0202, “Operating Experience Program,” Revision 8

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in BSEP AMP B.3.2 and associated bases documents against the GALL AMP X.E1 for consistency..

The project team reviewed those portions of the environmental qualification (EQ) program for which the applicant claims consistency with the AMP X.E1 in the GALL report, and determined that they are consistent the GALL report. Furthermore, the project team concluded that the applicant’s environmental qualification (EQ) program is adequate for managing component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR50.49(f) qualification methods.

The project team reviewed those portions of the BSEP AMP B.3.2, “Environmental Qualification (EQ) Program," which the applicant claims is consistent with GALL AMP X.E1, “Environmental Qualification (EQ) of Electrical Components,” and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s LRA AMP acceptable because it conforms to the recommended GALL AMP.

2.29.3 Exceptions to the GALL Report

None

2.29.4 Enhancements

None

2.29.5 Operating Experience

The applicant states, in the BSEP LRA, that its EQ program has been effective at managing aging effects; operating experience has identified no age related equipment failures that the program is intended to prevent. As stated in NUREG-1801, 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.

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 project team concludes that the applicant’s BSEP AMP B.3.2 will adequately manage the aging effects that are identified in BSEP LRA for which this AMP is credited.

2.29.6 UFSAR Supplement

The applicant provides its UFSAR Supplement for the environmental qualification (EQ) program in the BSEP LRA, Appendix A, Section A.1.2.3, which states that the thermal, radiation, and cyclical aging analyses of plant electrical and I&C components required to meet 10 CFR 50.49 and evaluated to demonstrate qualification for the 40- year life of the plant have been identified as time-limited aging analyses. The existing BSEP environmental qualification (EQ) program will adequately manage equipment aging for the period of extended operation, because equipment will be replaced prior to reaching the end of its qualified life. Reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and timeliness of reanalysis. Application of the EQ program assures that qualification of electric equipment required to meet 10 CFR 50.49 will be maintained throughout the period of extended operation.

The project team reviewed the UFSAR supplement for BSEP AMP B.3.2, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

2.29.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained 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 this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 3.0 AGING MANAGEMENT REVIEW RESULTS

The project team's audit and review activities for the BSEP AMRs and its conclusions regarding these reviews are documented in this section.

The project team determined that the AMRs results reported by the applicant to be consistent with the GALL Report are consistent with the GALL Report. The project also determined that the plant-specific AMRs results reported by the applicant to be justified on the basis of an NRC-approved precedent are technically acceptable and applicable. For AMRs results for which the GALL Report recommends further evaluation, the project team reviewed the applicant's evaluation to determine whether it adequately addresses the issues for which the GALL Report recommended further evaluation.

The AMRs that are within the scope of the project team are identified in Appendix D of the BSEP audit and review plan. These AMR line-items reviewed by the project team in Chapter 3 of the BSEP LRA Tables 3.X.2-Y were either consistent with the GALL Report or justified by the applicant on the basis of a previously approved position

In BSEP LRA Tables 3.X.2-Y, in addition to the notes, the applicant provided a summary of AMR results for the applicable systems, which included SCs, associated materials, environment, aging effect requiring management, and an AMP for each line-item. The notes describe how the information in the tables aligns with the information in the GALL Report. Those that are aligned with the GALL Report are assigned letters and are described below. Those defined by the applicant are assigned numbers and defined in the BSEP LRA.

> Note A indicates that the AMR line-item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report.
>
> Note B indicates that the AMR line-item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The project team concluded that the identified exceptions to the GALL AMPs are acceptable.
>
> Note C indicates that the component for the AMR line-item is different, but consistent with the GALL Report for material, environment, and aging effect. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The project team concluded that the AMR line-item of the different component was applicable to the component under review.
>
> Note D indicates that the component for the AMR line-item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The project team reviewed these line-items to verify consistency with the GALL Report. The project team concluded that the AMR line-item of the different component was applicable to the component under review. The project team concluded that the identified exceptions to the GALL AMPs are acceptable.

Note E indicates that the AMR line-item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The project team evaluated these line-items to determine that the AMP credited by the applicant is applicable.

Note F indicates that the material is not in the GALL Report for the identified component.

Note G indicates that the environment is not in the GALL Report for the identified component and material.

Note H indicates that the aging effect is not in the GALL Report for component, material, and environment combination.

Note I indicates that the aging effect in the GALL Report for the identified component, material, and environment combination is not applicable.

Note J indicates that neither the identified component nor the material and environment combination is evaluated in the GALL Report.

Discrepancies or issues identified by the project team during the audit and review that required a response from the applicant are documented in this audit and review report. If resolution of an issue was not docketed prior to issuing this audit and review report, a request for additional information (RAI) was prepared by the project team to solicit the information needed to disposition the issue. The RAI will be included and dispositioned in the SER related to the BSEP LRA. The list of RAIs associated with the audit and review report is provided in Attachment 4 to this audit and review report.

The project team conducted an audit and review of the information provided in the BSEP LRA program bases documents, which are available at the applicant's engineering office, and through interviews with BSEP technical staff.

On the basis of its audit and review, the project team found that the applicable aging effects were identified, the appropriate combination of materials and environments were listed, and acceptable AMPs were specified.

The AMR review results of BSEP LRA Sections 3.1 through 3.6 performed by the project team are provided in the following sections.

## 3.1 BSEP LRA Section 3.1 - Aging Management of Reactor Vessel, Internals, and Reactor Coolant System

In the BSEP LRA Section 3.1, the applicant provided the results of its AMRs for the reactor vessel, internals, and reactor coolant system.

In the BSEP LRA Tables 3.1.2-1 through 3.1.2-5, the applicant provides a summary of the AMRs results for component types associated with the: (1) reactor vessel and internals; (2) neutron monitoring system; (3) reactor manual control system; (4) control rod drive hydraulic system; and, (5) reactor coolant recirculation system. The summary information for each component type included: intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the BSEP LRA Table 3.1.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified, for each component type in the BSEP LRA Table 3.1.1, those components that are consistent with the GALL Report, those components which the GALL Report recommends further evaluation, and those components that are not addressed in the GALL Report together with the basis for their exclusion.

The project team conducted its audit and review in accordance with SRP-LR Section 3.1.3 and the BSEP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

### 3.1.1 Aging Management Review Results That Are Consistent With the GALL Report

For AMRs that the applicant states are consistent with the GALL Report and for which no further evaluation is recommended, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the BSEP LRA is acceptable.

The project team reviewed its assigned BSEP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the reactor vessel and internals, neutron monitoring system, reactor manual control system, control rod drive hydraulic system, and reactor coolant recirculation system components that are subject to an AMR.

#### 3.1.1.1 Crack Initiation and Growth in the Core Shroud and Core Plate (Welded and Mechanical Covers) in the Reactor Vessel

Table 3.1.2-1 in the BSEP LRA includes AMR results line items for core shroud and core plate access hole covers (AHCs) that are constructed of nickel-based alloys and exposed to treated water on their external surface. The reactor vessel and internals structural integrity program (BSEP AMP B.2.28) and the water chemistry program (BSEP AMP B.2.2) are specified to manage cracking due to SCC for these components. GALL Report line item IV.B1.1-d is referenced, which recommends ASME Section XI inservice inspection, Subsections IWB, IWC, and IWD (GALL AMP XI.M1) for Class 1 components, along with the water chemistry program (GALL AMP XI.M2) to manage this aging effect. In addition, since cracking initiated in crevice regions of AHC welds is not amenable to visual inspection under the ASME Section XI inservice inspection program, an augmented inspection, including ultrasonic testing (UT) or other demonstrated acceptable inspection, is also recommended in the GALL Report for AHC welds containing crevices. This augmented inspection is not addressed in the applicant's AMR.

The project team requested that the applicant provide clarification as to the discrepancy between the AMPs specified in the BSEP LRA and the AMPs recommended in the GALL Report for managing crack initiation due to SCC for the core shroud and core plate AHCs; and why the augmented inspection program for the BSEP AHCs, which covers welded components, is not discussed in the BSEP LRA. In its letter dated March 14, 2005 (ML050810493), the applicant stated that the ASME Section XI inservice inspection requirements are captured as part of the reactor vessel and internals structural integrity program. As stated in Section B.2.28 of the BSEP LRA,

> The Reactor Vessel and Internals Structural Integrity Program is an existing plant-specific program that includes: Inspection in accordance with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and inspection and flaw evaluation in conformance with the guidelines of the BWR Owner's Group, Boiling Water Reactor Vessel and Internals Project (BWRVIP) documents.

In addition, the applicant stated that the procedures that implement the reactor vessel and structural integrity program include enhanced inspections of the access hole covers. Specifically, the inspections performed may be either a UT (ultrasonic) or an EVT-1 (enhanced VT-1). However, EVT-1 is not consistent with the discussion in the AMR line for core shroud/core plate AHC, which states the examination should be a UT examination method. This issue will be dispositioned by DE in the BSEP LRA SER in conjunction with their review of BSEP AMP B.2.28 and is being tracked as RAI B.2.28-6, Parts A and B.

On the basis of its review, with the exception of DE RAI B.2.28-6, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.1.1.2 Reduction of Fracture Toughness for Cast Austenitic Stainless Steel (CASS) Piping in the Reactor Coolant Recirculation System

Table 3.1.2-5 in the BSEP LRA includes an AMR line item for piping and fittings in the reactor coolant recirculation system that are constructed of CASS and exposed to treated water. The one-time inspection program (BSEP AMP B.2.15) is specified to manage reduction of fracture toughness due to thermal aging embrittlement for these components. GALL Report line item IV.C1.1-g is referenced, which recommends the thermal aging embrittlement of Cast Austenitic Stainless Steel (CASS) program (GALL AMP XI.M12) to manage this aging effect. Item 3.1.1-24 in Table 3.1.1 of the BSEP LRA is also referenced for this AMR, which states that BSEP does not have CASS piping in the RCS, except for the main steam line flow limiters and the reactor coolant recirculation pump discharge flow elements. These components are assumed to be susceptible to thermal embrittlement; however, the need for an AMP may be avoided based on a formal screening for susceptibility. The description of the one-time inspection program in Section B.2.15 of the BSEP LRA also states that managing reduction of fracture toughness due to thermal aging embrittlement for CASS components may not be necessary based on the outcome of a review of material susceptibility.

The project team noted that the BSEP LRA does not address when this screening will be completed. The project team asked the applicant to provide clarification as to when the screening of BSEP CASS components for material susceptibility to thermal embrittlement will be completed, and how the BSEP one-time inspection program compares to GALL AMP XI.M12, which is recommended in the GALL Report for managing reduction of fracture toughness for susceptible CASS components. Also, the applicant was asked to explain why the one-time inspection program is used to manage thermal embrittlement in CASS components instead of

the reactor vessel and internals structural integrity program, since BSEP LRA Table B-1, Correlation of The GALL Report and BSEP Aging Management Programs, indicates that GALL AMP XI.M12 is part of their reactor vessel and internals structural integrity program.

In its letter dated March 14, 2005 (ML050810493) the applicant stated that the initial screening for material susceptibility to thermal embrittlement of the main steam line flow limiters and reactor coolant recirculation pump discharge flow elements has been completed. It has been determined that these components are not susceptible to reduction of fracture toughness due to thermal aging embrittlement. Therefore, the affected AMR results will be updated to reflect this, and the one-time inspection program will be updated to remove these components from the program.

The project team reviewed the applicant's response and determined that it is acceptable on the basis that the applicant completed its screening for material susceptibility and determined that there are no CASS piping and fittings that are susceptible to thermal embrittlement. Therefore, the aging effect identified in the AMR for recirculation system piping and fittings is no longer applicable. The applicant has committed to update the affected AMRs to reflect the results of the BSEP screening for susceptibility of CASS components to thermal embrittlement, and to update the one-time inspection AMP to remove these components.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.1.1.3 Loss of Material, Loss of Preload, and Crack Initiation and Growth of Pressure-Retaining Bolting in High Pressure and High Temperature Systems

Table 3.1.2-5 in the BSEP LRA includes AMR line items for recirculation pump closure bolting that is constructed of low alloy steel and exposed to indoor air. The bolting integrity program (BSEP AMP B.2.6) is specified to manage loss of material and loss of pre-load for these components. GALL Report line items IV.C1.2-d and IV.C1.2-e, respectively, are referenced, and both recommend the bolting integrity program (GALL AMP XI.M18) to manage this aging effect. Generic Note B is listed for these AMRs indicating consistency with the GALL Report, with the exception that the BSEP AMP takes exceptions to the AMP recommended in the GALL Report.

The project team compared the BSEP bolting integrity program to the AMP recommended in the GALL Report and determined that the exceptions stated for the BSEP AMP effectively remove the ASME inservice inspection requirements from this AMP. Therefore, the project team reviewed and determined that the BSEP bolting integrity program alone is not sufficient to manage aging for the AMRs in question since it does not include the ASME inservice inspection requirements.

As part of its audit of the AMRs for the engineered safety features systems in Section 3.2 of the BSEP LRA, the project team asked for clarification on the bolting integrity program as it relates to pressure retaining bolting. In its letter dated March 14, 2005 (ML050810493), the applicant committed to revising the BSEP bolting integrity program to include the ASME inservice inspection requirements, along with monitoring and trending activities for pressure-retaining bolting. The project team's question and evaluation are discussed in Section 3.2.1.1 of this audit report. The submission of a revised AMP that includes the ASME ISI requirements will resolve the discrepancy noted above. On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

Conclusion

On the basis of its audit and review, the project team reviewed and determined that for AMRs not requiring further evaluation, as identified in the BSEP LRA Table 3.1.1 (Table 1), the applicant's references to the GALL Report are acceptable and 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2 Aging Management Review Results For Which Further Evaluation Is Recommended By The GALL Report

For some line-items assigned to the project team in the BSEP LRA Tables 3.1.2-1 through 3.1.2-5, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in BSEP LRA Section 3.1.2.2 against the criteria provided in the SRP-LR Section 3.1.3.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.1 citing the item in Table 1.

3.1.2.1 Cumulative Fatigue Damage (BSEP LRA Section 3.1.2.2.1)

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the BSEP LRA. Therefore, the project team did not review this item.

3.1.2.2 Loss of Material Due to Crevice and Pitting Corrosion (BSEP LRA Section 3.1.2.2.2)

3.1.2.2.1 Steam Generator Shell Crevice and Pitting Corrosion (BSEP LRA Section 3.1.2.2.2.1)

Loss of material for a steam generator shell assembly is applicable to PWRs only.

3.1.2.2.2 Isolation Condenser Crevice and Pitting Corrosion (BSEP LRA Section 3.1.2.2.2.2)

BSEP does not have an isolation condenser.

3.1.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement (BSEP LRA Section 3.1.2.2.3)

3.1.2.3.1 Neutron Irradiation Embrittlement TLAA (BSEP LRA Section 3.1.2.2.3.1)

Neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the BSEP LRA. Therefore, the project team did not review this item.

3.1.2.3.2 Reactor Vessel Embrittlement (BSEP LRA Section 3.1.2.2.3.2)

In BSEP LRA Section 3.1.2.2.3.2 the applicant states that loss of fracture toughness due to neutron irradiation embrittlement could occur in the reactor vessel. A materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. The BSEP reactor vessel surveillance program, and the results of its evaluation for license renewal, are presented in Appendix B.

Reactor vessel embrittlement is reviewed by NRR DE staff and addressed in Appendix B of the SER related to the BSEP LRA. Therefore, the project team did not review this item.

3.1.2.4 Crack Initiation and Growth Due to Thermal and Mechanical Loading or Stress Corrosion Cracking (BSEP LRA Section 3.1.2.2.4)

3.1.2.4.1 Small-Bore Reactor Coolant System and Connected System Piping (BSEP LRA Section 3.1.2.2.4.1)

The project team reviewed BSEP LRA Section 3.1.2.2.4.1 against the criteria in SRP-LR Section 3.1.2.2.4.1, which states:

> Crack initiation and growth due to thermal and mechanical loading or SCC (including intergranular stress corrosion cracking [IGSCC]) could occur in small-bore reactor coolant system and connected system piping less than NPS 4. The existing program relies on ASME Section XI ISI and on control of water chemistry to mitigate SCC. The GALL Report recommends that a plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping be conducted to ensure that cracking has not occurred, and the component intended function will be maintained during the extended period. The AMPs should be augmented by verifying that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. A one-time inspection of a sample of locations is an acceptable method to ensure that the aging effect is not occurring and the component's intended function will be maintained during the period of extended operation.

In BSEP LRA Section 3.1.2.2.4.1, the applicant states that, by letter dated April 20, 2001, BSEP requested approval for risk informed inservice inspection (RI ISI). Approval was received by letter from R. Correia (USNRC) to J. Keenan (CP&L), dated November 28, 2001: "Brunswick Steam Electric Plant, Unit Nos. 1 and 2 – Safety Evaluation for the Risk Informed Inservice Inspection (RI ISI) Program (TAC Nos. MB1760 and MB1761)" (ML013320632). 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 risk informed inservice inspection 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 stress corrosion cracking of these lines is bounded by those components selected for inservice inspection as part of risk informed 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 project team noted that a risk informed ISI evaluation is not an acceptable technical basis for excluding small-bore Class 1 piping from one-time inspection, as recommended by the SRP-LR. Staff approval of a RI-ISI program is only for the current inspection interval and does not cover the extended period of operation.

During its audit and review of the BSEP one-time inspection program (AMP B.2.15), the project team rejected the applicant's technical basis for not including inspections of small bore Class 1 piping in the scope of the AMP. The project team requested that the applicant submit a revision to its one-time inspection program that includes small-bore piping in the program scope and describes an inspection plan that is consistent with the guidance in GALL Report AMP XI.M32. In response, the applicant stated that BSEP will revise the one-time inspection program to be consistent with GALL Report AMP XI.M32. The project team's evaluation of BSEP AMP B.2.15 is documented in Section 2.15 of this audit report. On the basis of its review, the project team found AMP B.2.15 to be acceptable.

Additionally, the project team requested that the applicant identify all required revisions to the BSEP LRA in order to be consistent with its new commitment and to include small bore Class 1 piping in the scope of the one-time inspection program. In its letter dated May 4, 2005 (ML051330020), the applicant identified the revisions to the BSEP LRA specifying how BSEP will use the One-Time Inspection Program for aging management of small-bore Class 1 piping inspections regarding cracking due to thermal and mechanical loading and SCC. The revision includes specifying the ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program and the Water Chemistry Program for aging management, and use of the One-Time Inspection Program for verification of program effectiveness, consistent with the recommendations of GALL. Also, the ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program will no longer credit RI-ISI in aging management.

Based on the applicant's new commitment to include small bore Class 1 piping in the scope of the one-time inspection program and to revise the BSEP LRA as identified above, the project team reviewed and determined that the applicant has met the criteria of SRP-LR Section 3.1.2.2.4.1 for further evaluation. For those AMRs whose further evaluation is provided in BSEP LRA Section 3.1.2.2.4.1, the project team concluded that the AMRs are now consistent with the GALL Report and are acceptable.

3.1.2.4.2 Reactor Vessel Flange Leak Detection Line and Jet Pump Sensing Line (BSEP LRA Section 3.1.2.2.4.2)

The project team reviewed BSEP LRA Section 3.1.2.2.4.2 against the criteria in SRP-LR Section 3.1.2.2.4.2, which states:

> Crack initiation and growth due to thermal and mechanical loading or SCC (including IGSCC) could occur in BWR reactor vessel flange leak detection lines and BWR jet pump sensing lines. The GALL Report recommends that a plant specific aging management program be evaluated to mitigate or detect crack initiation and growth due to SCC of vessel flange leak detection lines.

In BSEP LRA Section 3.1.2.2.4.2, the applicant states that the reactor vessel flange leak detection line at BSEP is a Class 2 line that is normally dry. The BSEP AMR methodology assumed that this stainless steel line is exposed to treated water and, therefore, is susceptible to stress corrosion cracking. This aging effect will be managed with a combination of the water

chemistry program and the one-time inspection program.

The project team reviewed and determined that cracking due to SCC in the reactor vessel flange leak detection line is possible since the stainless steel lines are exposed to treated water at high temperature. However, these lines normally remain dry during reactor operation, unless a leak develops between the closure head and vessel head flanges. The water chemistry program would minimize susceptibility to SCC should a leak develop in the system. A one-time inspection of this small bore piping would provide reasonable assurance that cracking due to SCC is not occurring. If degradation is detected, then appropriate action would be taken to mitigate the aging effect. Therefore, the project team reviewed and determined that the applicant's approach for managing cracking due to SCC in vessel flange leak detection lines is acceptable on the basis that it provides reasonable assurance that the effects of aging will be adequately managed.

The applicant also states, in BSEP LRA Section 3.1.2.2.4.2, that the jet pump sensing lines were evaluated for flow induced vibration as part of the extended power uprate (EPU). This evaluation determined that the sensing line natural frequency of interest is well separated from the vane passing frequency of the recirculation pumps at EPU conditions. The failure of a sensing line at any location would be detected during jet pump surveillance, which is performed at least daily. Failure of a sensing line does not affect the pressure measurement taken for post-accident water level monitoring. If one or more jet pumps are inoperable, the plant must be brought to mode 3 within 12 hours. Therefore, the applicant claims that no aging management program is required.

The project team reviewed the BSEP Task T0305 report: "RPV Flow Induced Vibration of the Project Task Report, Brunswick Nuclear Plant Unit 1 and 2 Extended Power Uprate," GE-NE-A22-00113-11-01, Rev. 0, Class III, June 2001, and confirmed the applicant's claim that there is no resonance between the vane passing frequency of the recirculation pump and the natural frequency of the jet pump sensing lines. The project team noted that Table 2.3.1-1 in the BSEP LRA, component/commodity groups requiring aging management review and their intended functions: reactor vessel and internals, identifies M-4 (provides structural support/seismic integrity) as the only intended function for these lines. The intended function M-1 (provides pressure retaining boundary), which the project team expected for the portion of the jet pump sensing line external to the reactor vessel, was not identified. The project team requested that the applicant provide clarification on how aging management of the jet pump sensing line external to the reactor vessel is addressed.

In its response, the applicant stated that the jet pump sensing lines that are external to the reactor vessel are evaluated as part of the component/commodity group "piping and fittings (small bore piping less than NPS 4)." This component/commodity group is evaluated in Table 3.1.2-1 of the BSEP LRA. The applicant also noted that the AMR for this line item will be revised to add the one-time inspection program.

The project team reviewed and determined the applicant's response acceptable on the basis that the portion of the jet pump sensing line external to the reactor vessel is included in the commodity group for small bore piping, which is addressed in Table 3.1.2-1. The portion of the jet pump sensing line internal to the reactor vessel is submerged in reactor coolant and its failure would not have any consequence in terms of a reactor coolant leak. Therefore, the portion of the jet pump sensing line internal to the reactor vessel does not have an intended pressure retaining boundary function, and the applicant's identification of intended function M-4, provide structural support/seismic integrity, is appropriate.

The project team reviewed and determined that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.4.2 for further evaluation. For those AMRs whose further evaluation is provided in BSEP LRA Section 3.1.2.2.4.2, the project team concluded that the applicant is consistent with the GALL Report and the AMRs are acceptable.

3.1.2.4.3 Isolation Condenser Components (BSEP LRA Section 3.1.2.2.4.3)

In BSEP LRA Section 3.1.2.2.4.3, the applicant states that crack initiation and growth due to SCC or cyclic loading for a BWR isolation condenser is not applicable since BSEP does not have an isolation condenser.

On the basis that BSEP does not have any components from this group, the project team concurs with the applicant's determination that this aging effect is not applicable to BSEP.

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the GALL Report recommends further evaluation, the project team determines that the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Aging Management Review Results That Are Not Consistent With the GALL Report or Are Not Addressed in the GALL Report

AMRs that are plant specific and are not consistent with the GALL Report, as identified in BSEP LRA Table 2s with generic Notes F through J, are reviewed by NRR DE staff and will be addressed in Section 3 of the BSEP LRA SER.

3.2 BSEP LRA SECTION 3.2 - AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES

In the BSEP LRA Section 3.2, the applicant provided the results of its AMRs for the engineered safety features systems.

In the BSEP LRA Tables 3.2.2-1 through 3.2.2-9, the applicant provided a summary of the AMRs for components/commodities in the (1) residual heat removal (RHR) system; (2) containment atmosphere control (CAC) system; (3) high pressure coolant injection (HPCI) system; (4) automatic depressurization system (ADS); (5) core spray (CS) system; (6) standby gas treatment system (SGTS); (7) standby liquid control (SLC) system; (8) HVAC control building system; and (9) reactor protection system.

The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the BSEP LRA Table 3.2.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in the BSEP LRA Table 3.2.1 those components that are consistent with the GALL Report, those components which the GALL Report recommends further evaluation, and those that are not addressed in the GALL Report

with the basis for their exclusion.

The project team conducted its audit and review in accordance with SRP-LR Section 3.2.3 and the BSEP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

3.2.1 Aging Management Review Results That Are Consistent With the GALL Report

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the BSEP LRA is acceptable.

The project team reviewed its assigned BSEP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the residual heat removal (RHR), containment atmosphere control (CAC), high pressure coolant injection (HPCI) , automatic depressurization (ADS), core spray (CS), standby gas treatment system (SGTS), standby liquid control (SLC), HVAC control building, and reactor protection systems components that are subject to an AMR.

3.2.1.1 Loss of Material and Crack Initiation and Growth in Closure Bolting in High Pressure and High Temperature Systems

In the discussion section of BSEP LRA Table 3.2.1, item number 3.2.1-18 addresses aging management of closure bolting in the ESF systems, the applicant states that the BSEP bolting integrity program (BSEP AMP B.2.6) is not applicable since this system does not use high strength pressure boundary bolting. For non-Class 1 closure bolting, the applicant considers bolting to be a sub-component of the associated component; therefore, bolting materials are not itemized as a separate component and the bolting integrity program is not needed for aging management.

During the audit and review, the project team reviewed BSEP LRA Tables 3.2.2-1 through 3.2.2-9 and noted that the applicant specifies the systems monitoring program (BSEP AMP B.2.29) for visual inspection of the external surfaces of components in the ESF systems, including any bolting associated with the component, to identify general corrosion. However, this AMP does not address the crack initiation and growth aging effect for pressure retaining bolting. The bolting integrity program (GALL AMP XI.M18) is recommended in the GALL Report to manage loss of material due to general corrosion, and crack initiation and growth due to cyclic loading and/or SCC for all closure bolting in high-pressure or high-temperature systems that is in the scope of license renewal. The AMP recommended in the GALL Report does not exclude non-Class 1 bolting.

The project team reviewed the bolting integrity program (BSEP AMP B.2.6), and its evaluation is documented in Section 2.6 of this audit report. The applicant claims that this program is consistent with GALL AMP XI.M18. However, BSEP AMP B.2.6 has several major exceptions. For non-Class 1 pressure retaining bolting, BSEP AMP B.2.6 excludes the ASME Section XI inservice inspection activities, along with monitoring and trending under the systems monitoring program. Therefore, the project team reviewed and determined that the bolting integrity program, as presented in the BSEP LRA, would not be adequate to manage all of the aging effects identified for the non-Class 1 pressure retaining bolting.

The project team asked the applicant to clarify how aging management of pressure retaining bolting in the ESF systems would be managed during the extended period of operation.

In its letter dated March 14, 2005 (ML050810493), the applicant provided the following response:

> The Bolting Integrity Program will be revised to include Section XI activities identified in the GALL Report, as well as aspects of monitoring and trending under systems monitoring for bolted connections outside of Section XI boundaries. Subsequent to these revisions, the Bolting Integrity Program will be consistent with the GALL Report with the exception that structural bolting is not addressed.
>
> Additionally, aging management review summaries in BSEP LRA Sections 3.1, 3.2, 3.3 and 3.4 will be revised to address aging management requirements for each of the aging effects identified in GALL AMR line items pertaining to closure bolting in high pressure or high temperature systems. The following information will be included in these aging management reviews:
>
> (1) in general, BSEP treats bolting as a sub-component of the parent component, and bolting does not have a separate line item in system level aging management reviews
> (2) the GALL Report identifies loss of material, loss of preload and cracking as applicable aging effects for high temperature, high pressure bolting
> (3) the Bolting Integrity Program (updated as described above) is specified to manage these aging effects.

The project team reviewed and determined that, upon completion of the revisions noted in the applicant's response above, the bolting integrity program will be consistent with the GALL Report for all pressure retaining bolting. Structural bolting will not be addressed. Since BSEP treats bolting as a sub-component of the pressure-retaining components, there are no separate AMRs in the BSEP LRA for bolting in the ESF system. However, the applicants commitment to specify the bolting integrity program to manage all of the aging effects identified in the GALL Report for components containing Class 1 and non-Class 1 pressure retaining bolting will resolve this discrepancy.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.2.1.2 Loss of Material for Valve Bodies in the Residual Heat Removal System

In the discussion section of Table 3.2.2-1 in the BSEP LRA, the applicant states that it includes AMR line items for valve bodies and bonnets in the residual heat removal system that are constructed of copper alloys and stainless steel, and exposed to raw water internally. The open-cycle cooling water system program (BSEP AMP B.2.7) is specified to manage loss of material due to various corrosion mechanisms, and flow blockage due to fouling for these components. In addition, the selective leaching of materials program (BSEP AMP B.2.16) is specified to manage loss of material due to selective leaching for the copper alloy components. GALL Report line item VII.C1.2-a is referenced, which also recommends the open-cycle cooling water system program (GALL AMP XI.M20) and the selective leaching of materials program (GALL AMP XI.M33). However, the AMRs identify generic Note E, indicating they are consistent with GALL with the exception of the AMP.

During the audit and review the project team noted that other AMRs in Table 3.2.2-1 for piping

and heat exchangers with similar materials and environments in this system identify generic Notes A or B, indicating that the AMPs are consistent with GALL. The project team asked the applicant to clarify this apparent inconsistency in the generic notes.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that the AMR line items for valves should be consistent with comparable line items for piping and heat exchanger components. Specifically, the line item for valves (body and bonnet) in Table 3.2.2-1 associated with flow blockage due to fouling, loss of material due to crevice corrosion, loss of material due to MIC, and loss of material due to pitting corrosion should appropriately include generic Note A, and that for selective leaching should include generic Note B.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.2.1.3 Loss of Material for Carbon Steel Piping and Fittings in the HVAC Control Building System

In the discussion section of Table 3.2.2-8 in the BSEP LRA the applicant states that it includes an AMR line item for piping and fittings in the HVAC control building system that are constructed of carbon steel and exposed to indoor air on the internal surfaces. The preventive maintenance program (BSEP AMP B.2.30) is specified to manage loss of material due to general corrosion for these components. However, GALL Report line item VII.D.1-a is referenced, which recommends the compressed air monitoring program (GALL AMP XI.M24) to manage this aging effect. During the review and audit the project team requested clarification on what preventive maintenance is performed on these components, and how their interior surfaces are inspected for general corrosion by the preventive maintenance program.

In its response, the applicant stated that this AMR line item represents one pipe nipple with a threaded connection to one drain trap from each of two instrument air receivers. The preventive maintenance program will be enhanced to include activities to inspect the drain traps and the pipe nipple for the extended period of operation.

The project team reviewed and determined that the enhancement to the BSEP preventive maintenance program to include inspection of the drain trap and pipe nipple will provide an acceptable means of managing loss of material due to general corrosion for the carbon steel piping and fittings addressed in this AMR line item.

With regard to the compressed air monitoring program, the applicant stated that this program is not used at BSEP. The applicant's justification and the project team's evaluation are discussed in Section 3.2.1.4 of this audit report.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.2.1.4 Loss of Material for Carbon Steel Air Receivers in the HVAC Control Building System

In the discussion section of Table 3.2.2-8 in the BSEP LRA the applicant states that it includes an AMR line item for air receivers (shell and access cover) in the HVAC control building system that are constructed of carbon steel and exposed to indoor air on their internal surfaces. The BSEP one-time inspection program (BSEP AMP B.2.15) is specified to manage loss of material

due to general corrosion for these components. However, GALL Report line item VII.D.3-a is referenced, which recommends the compressed air monitoring program (GALL AMP XI.M24) to manage this aging effect. During the audit and review the project team asked the applicant to provide justification for using the one-time inspection program to manage general corrosion on the interior surfaces of the air receivers instead of the compressed air monitoring program.

In its response, the applicant stated that this line item represents two air receivers in the HVAC control building system which receive dry compressed air. Even though the inlet air is dried using an air dryer, any condensation is removed from the bottom of the tank through a piping and trap arrangement. The expectation is that these air receivers will not exhibit loss of material due to general corrosion. However, because the potential for condensation exists in the bottom of the tank, the two air receivers were conservatively assigned the aging effect of loss of material due to general corrosion.

The applicant also stated that the one-time inspection program in the GALL Report (GALL AMP XI.M32) is appropriate for the subject air receivers. Also NRC staff has accepted that a one-time inspection may be used to provide additional assurance that aging that has not yet manifested itself is not occurring, that the evidence of aging shows that the aging is so insignificant that an aging management program is not warranted. A one-time inspection may also trigger development of a program necessary to assure component intended functions through the period of extended operation. However, there may be locations that are isolated from the flow stream for extended periods and are susceptible to the gradual accumulation or concentration of agents that promote certain aging effects. This program provides inspections that either verify that unacceptable degradation is not occurring or trigger additional actions that will assure the intended function of affected components will be maintained during the period of extended operation.

For aging management of the subject components, the one-time inspection program will verify that the expectation is correct, or it will determine the extent of the degradation present so that corrective actions can be taken. The applicant stated that this is the approach used at BSEP and, based on the program description in The GALL Report, it is not a deviation from GALL Report recommendations. Since the piping components have a threaded connection, the air receiver inspections will likely be performed with the use of a boroscope or a volumetric examination or a combination of the two techniques.

With regard to the compressed air monitoring program recommended in the GALL Report, the applicant stated in its response to the audit question that this AMP is not used at BSEP. The supply of dry instrument air to pneumatic controllers, dampers and other pneumatic controls is provided by an air dryer located upstream of the devices served. The instrument air dryer is located downstream of the instrument air compressors. The compressed air is dried and cooled by a refrigerant type dryer. BSEP program document 0ENP-53, “Instrument Air System Analysis and Tracking Program,” Revision 4, provides instructions to periodically test the quality of the instrument air. This procedure is a result of the Brunswick Nuclear Plant response to Nuclear Regulatory Commission Generic Letter 88-14, committing to "maintain instrument air quality," and to establish a program to "include periodic sampling of the air quality of the Instrument Air System." This procedure evaluates, tracks and trends the test results to verify that they have met the minimum requirements. Locations tested are monitored for dew point (each quarter), entrained particulates exceeding 3 microns (every 18 months) and hydrocarbon contaminates (every 18 months). The selected test locations provide a representative sample of the instrument air system, diesel generator starting air system, and the HVAC control building system. BSEP document 0E&RC-0900, “Operation of Panametrics System 580 Hygrometer and

Sampling of the Instrument Air System," Revision 4, lists the control building HVAC instrument air subsystem test location.

The applicant further stated in its response to the audit question that, for the majority of the HVAC control building system instrument air components, loss of material was not identified as an aging effect for instrument air components subject to aging management based on the dry air delivered by the air dryer. Dry air is provided by system design, and is maintained by system operation and testing requirements as discussed above. Moisture downstream of the air dryer is controlled. BSEP currently uses procedures to periodically test air quality using representative samples, review trend data and initiate corrective actions as appropriate for the instrument air system. BSEP has completed steps to periodically test air quality, review trend data and initiate corrective actions as appropriate for the instrument air system and has met the intent of Generic Letter 88-14.

The applicant also provided copies of 0ENP-53, "Instrument Air System Analysis and Tracking Program," Revision 4, and 0E&RC-0900, "Operation of Panametrics System 580 Hygrometer and Sampling of the Instrument Air System," Revision 4. The project team reviewed these documents and confirmed that, for the majority of the HVAC control building system instrument air components, dry air is provided by system design and is maintained by system operation and testing requirements to meet the intent of the compressed air monitoring system AMP recommended in the GALL Report.

The project team reviewed and determined that, although the applicant has not credited an AMP consistent with the GALL Report, there are procedures and programs in place at BSEP that perform the activities included in the compressed air monitoring program recommended in the GALL Report. Therefore, the one-time inspection program, together with the existing plant programs and procedures, meet the intent of the compressed air monitoring program.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

Conclusion

On the basis of its audit and review, the project team reviewed and determined that for AMRs not requiring further evaluation, as identified in the BSEP LRA Table 3.2.1 (Table 1), the applicant's references to the GALL Report are acceptable and 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.2.2 Aging Management Review Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

For some line-items assigned to the project team in the BSEP LRA Tables 3.2.2-1 through 3.2.2-9, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in BSEP LRA Section [3.2.2.2 against the criteria provided in the SRP-LR Section 3.2.3.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.2 citing the item in Table 1.

#### 3.2.2.1 Cumulative Fatigue Damage (BSEP LRA Section 3.2.2.2.1)

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the BSEP LRA

3.2.2.2 Loss of Material Due to General Corrosion (BSEP LRA Section 3.2.2.2.2)

3.2.2.2.1 Areas with Stagnant Flow Conditions (BSEP LRA Section 3.2.2.2.2.1)

The project team reviewed BSEP LRA Section 3.2.2.2.2.1 against the criteria in SRP-LR Section 3.2.2.2.2.1, which states:

> The management of loss of material due to general corrosion of pumps, valves, piping, and fittings associated with some of the BWR emergency core cooling systems [high pressure coolant injection, reactor core isolation cooling, high pressure core spray, low pressure core spray, low pressure coolant injection (residual heat removal)] and with lines to the suppression chamber and to the drywell and suppression chamber spray system should be further evaluated. The existing aging management program relies on monitoring and control of primary water chemistry based on BWRVIP 29 (EPRI TR-103515) for BWRs to mitigate degradation. However, control of primary water chemistry does not preclude loss of material due to general corrosion at locations of stagnant flow conditions. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general corrosion to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

In BSEP LRA Section 3.2.2.2.2.1, the applicant states that loss of material due to general corrosion is predicted for carbon steel components exposed to treated water in the ECCS, and is managed by the water chemistry and one-time inspection programs. The water chemistry program manages aging effects through periodic monitoring and control of contaminants. Since control of water chemistry does not preclude corrosion at locations of stagnant flow conditions, the one-time inspection program will provide a verification of the effectiveness of the water chemistry program to manage loss of material due to general corrosion through examination of carbon steel ECCS components.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.2.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.2 Interior and Exterior Surfaces of Carbon Steel Components (BSEP LRA Section 3.2.2.2.2.2)

The project team reviewed BSEP LRA Section 3.2.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.2, which states:

> Loss of material due to general corrosion could occur in the drywell and suppression chamber spray (BWR) systems header and spray nozzle components, standby gas treatment system components (BWR), containment isolation valves and associated piping, the automatic depressurization system piping and fittings (BWR), emergency core cooling system header piping and fittings and spray nozzles (BWR), and the external surfaces of BWR carbon steel components. The GALL Report recommends further evaluation on a plant specific basis to ensure that the aging effect is adequately managed.

In BSEP LRA Section 3.2.2.2.2.2, the applicant states that the preventive maintenance program is used to manage loss of material due to general corrosion on interior surfaces of filter housings and ductwork in the standby gas treatment system. Loss of material due to external corrosion of carbon steel components is predicted by BSEP for components in air/gas environments exposed to moisture. To manage this aging effect/mechanism, the systems monitoring program will be used. This program provides for scheduled visual inspections to ensure that aging degradation that might lead to loss of intended functions will be detected.

The project team noted that the SRP-LR Section 3.2.2.2.2-2 requires aging management of several other components in the ESF systems, including the drywell and suppression chamber spray systems header and spray nozzle components, containment isolation valves and associated piping, and the automatic depressurization system piping and fittings and spray nozzles. These components are not addressed in the BSEP LRA.

The project team requested that the applicant explain how loss of material due to general corrosion on the interior surfaces of the aforementioned components would be managed.

In its letter dated March 14, 2005 (ML050810493), the applicant provided the following further evaluations for each of the items identified:

> Drywell and suppression chamber spray systems header: The SRP-LR identifies loss of material due to general corrosion as a potentially applicable aging effect for the drywell and suppression chamber spray systems header. Aging management reviews have identified that carbon steel piping in normally wetted portions of these subsystems is susceptible to general corrosion, managed by the water chemistry program with a verification of program effectiveness using the one-time inspection program. Regarding the portion of the Suppression Pool (Torus) Spray subsystem downstream of the isolation valves, this piping is normally not wetted or pressurized, but rather exposed to the primary containment environment. Since the primary containment is inerted with nitrogen during operation, no significant corrosion of this piping is expected as a result. Similarly, drywell spray is considered a safety-related function, but is not expected to be used except in post accident conditions and the drywell spray headers are not subject to alternate wetting. This piping is assumed to be dry and normally exposed to the inerted drywell environment, and significant corrosion is not expected. Hence general corrosion of drywell and suppression chamber spray is not considered to be an aging mechanism requiring aging management.

The project team reviewed and determined that the applicant's evaluation for the drywell and suppression chamber spray systems header is acceptable on the basis that the wetted portion of the drywell and supression chamber spray system header would be subject to loss of material due to general corrosion, and the water chemistry program and one-time inspection program specified by the applicant will adequately manage this aging effect. Further, the dry portion of the piping will not experience corrosion, and the applicant appropriately concluded that these components do not require aging management.

> Drywell and suppression chamber spray systems spray nozzle components: As noted above, the suppression spray function is not safety-related at BSEP, hence, the suppression spray nozzles do not perform an intended function. Drywell spray is a safety-related function. The drywell spray nozzles are constructed of brass and installed in a normally dry, inerted environment. As such, they are not subject to general corrosion and aging management is not required.

The project team reviewed and determined that the applicant's justification for the drywell and suppression chamber spray nozzle components not being subject to general corrosion is acceptable on the basis that the these brass components will not experience any corrosion in a dry environment.

> Containment isolation valves and associated piping: BSEP has not performed a separate aging management review of containment isolation valves and associated piping, but rather addressed aging management reviews of these components within the aging management reviews of the systems in which they occur. The BSEP methodology used for system aging management reviews conservatively predicts general corrosion in those applications where it might be applicable. Additional information regarding the aging management programs applied to manage general corrosion of containment isolation valves and associated piping is provided in line items for "Valves (including check valves and containment isolation) (body and bonnet)" in System AMR Tables 3.1.2, 3.2.2, 3.3.2 and 3.4.2.

The project team reviewed and determined that the applicant's approach for managing loss of material due to general corrosion in containment isolation valves and associated piping is acceptable on the basis that these components are addressed as part of the aging management review of the systems in which they are contained.

> Automatic depressurization system piping and fittings and spray nozzles: BSEP includes the automatic depressurization system piping (S/RV downcomers) as part of the reactor vessel and internals system. Aging management review of these components are addressed in Section 3.1 of the BSEP LRA. These components are managed for general corrosion using the systems monitoring, water chemistry and one time inspection programs.

The project team reviewed and determined that the applicant's approach for managing loss of material due to general corrosion in automatic depressurization system piping and fittings, and spray nozzles is acceptable on the basis that these components are addressed as part of the reactor vessel and internals system, and their aging management review is included in Section 3.1 of the BSEP LRA.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3 Local Loss of Material Due to Pitting and Crevice Corrosion (BSEP LRA Section 3.2.2.2.3)

3.2.2.3.1 Areas with Stagnant Flow Conditions (BSEP LRA Section 3.2.2.2.3.1)

The project team reviewed BSEP LRA Section 3.2.2.2.3.1 against the criteria in SRP-LR Section 3.2.2.2.3.1, which states:

> The management of local loss of material due to pitting and crevice corrosion of pumps, valves, piping, and fittings associated with some of the BWR emergency core cooling system piping and fittings [high pressure coolant injection, reactor core isolation cooling, high pressure core spray, low pressure core spray, low pressure coolant injection (residual heat removal)] and with lines to the suppression chamber and to the drywell and suppression chamber spray system should be evaluated further. The existing aging management program relies on monitoring and control of primary water chemistry based on EPRI guidelines of TR-105714 for PWRs and BWRVIP 29 (EPRI TR-103515) for BWRs to mitigate degradation. However, control of coolant water chemistry does not preclude loss of material due to crevice and pitting corrosion at locations of stagnant flow conditions. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage the loss of material due to pitting and crevice corrosion to verify the effectiveness of the chemistry control program). A onetime inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly so that the component's intended function will be maintained during the period of extended operation.

In BSEP LRA Section 3.2.2.2.3.1 the applicant states that loss of material due to pitting and crevice corrosion is predicted by BSEP for carbon steel components exposed to treated water in ECCS Systems, and is managed by the water chemistry and one-time inspection programs. The water chemistry program manages aging effects through periodic monitoring and control of contaminants. Since control of water chemistry does not preclude corrosion at locations of stagnant flow conditions, the one-time inspection program will provide a verification of the effectiveness of the water chemistry program to manage loss of material due to pitting and crevice corrosion through examination of carbon steel ECCS components.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Interior and Exterior Surfaces of Carbon and Stainless Steel Components (BSEP LRA Section 3.2.2.2.3.2)

The project team reviewed BSEP LRA Section 3.2.2.2.3.2 against the criteria in SRP-LR Section 3.2.2.2.3.2, which states:

> Local loss of material from pitting and crevice corrosion could occur in the containment isolation valves and associated piping, and automatic depressurization system piping and fittings (BWR). The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In BSEP LRA Section 3.2.2.2.3.2 the applicant states that the preventive maintenance program is used to manage loss of material in filter housings and duct work in the standby gas treatment system. BSEP has addressed aging management of containment isolation valves and associated piping as a part of the system in which they reside. Generally, this entails, for exterior surfaces, use of the systems monitoring program, and use of the water chemistry program in conjunction with the one-time inspection program on the internal surfaces.

The project team noted that BSEP LRA Section 3.2.2.2.3.2 does not addresses aging management of the automatic depressurization system (ADS) piping and fitting, as recommended by SRP-LR Section 3.2.2.2.3.2. The project team asked the applicant to explain how loss of material due to pitting and crevice corrosion in the ADS piping and fittings will be managed for the extended period of operation.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that BSEP includes the ADS piping (S/RV downcomers) as part of the reactor vessel and internals system. Aging management review of these components are summarized Section 3.1 of the BSEP LRA, and have identified pitting and crevice corrosion as being applicable to wetted portions of these components. These aging management reviews have specified the water chemistry program for aging management, with program effectiveness verification performed under the one-time inspection program.

The project team reviewed and determined that the applicant's approach for managing loss of material due to pitting and crevice corrosion in the ADS piping and fittings is acceptable on the basis that these components are included in the reactor vessel and internals system and their aging management evaluation is addressed as part of that system.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.4 Local Loss of Material Due to Microbiologically Influenced Corrosion (BSEP LRA Section 3.2.2.2.4)

The project team reviewed BSEP LRA Section 3.2.2.2.4 against the criteria in SRP-LR Section 3.2.2.2.4, which states:

> Local loss of material due to microbiologically influenced corrosion (MIC)

> could occur in BWR and PWR containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL Report. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In BSEP LRA Section 3.2.2.2.4, the applicant states that BSEP has addressed aging management of containment isolation valves and associated piping as a part of the system in which they reside. Generally, this entails, for exterior surfaces, use of the systems monitoring program and use of the water chemistry program in conjunction with the one-time inspection program on the internal surfaces. BSEP has no service water lines inside the primary containment, and MIC is not a significant liability for containment isolation components.

The project team also interviewed the BSEP technical staff to determine which ESF components use service water for cooling and why MIC is not an issue for the containment isolation components. Based on the interview, it was determined that the RHR heat exchangers, ECCS pump coolers and the RHR pump seals are among the ESF components that are cooled by the service water. However, the containment isolation valves do not use service water for cooling and, therefore, they are not subject to MIC. Based on the information provided, the project team reviewed and determined that the applicants further evaluation is acceptable since service water is not used to cool the containment isolation valves.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.4 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.5 Changes in Properties Due to Elastomer Degradation (BSEP LRA Section 3.2.2.2.5)

The project team reviewed BSEP LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5, which states:

> Changes in properties due to elastomer degradation could occur in seals associated with the standby gas treatment system ductwork and filters. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In BSEP LRA Section 3.2.2.2.5, the applicant states that change in material properties (hardening, cracking) is predicted by the BSEP AMR methodology for elastomeric seals in the standby gas treatment system. The preventive maintenance program will be used to manage aging of the internal surfaces of these seals, whereas the systems monitoring program will be used to manage aging of visible external surfaces.

The project team reviewed and determined that the applicant's use of the preventive maintenance program and system monitoring program are acceptable since they will periodically verify the condition of the elastomers and provide reasonable assurance that hardening and cracking are not occurring.

The project team finds that, based on the programs identified above, the applicant has met the

criteria of SRP-LR Section 3.2.2.2.5 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.6 Loss of Material Due to Erosion of Charging Pump Flow Orifices (BSEP LRA Section 3.2.2.2.6)

This issue is applicable only to charging pumps in the chemical and volume control systems of PWRs.

3.2.2.7 Buildup of Deposits Due to Corrosion in Drywell and Torous Spray Nozzles and Flow Orifices (BSEP LRA Section 3.2.2.2.7)

The project team reviewed BSEP LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7, which states:

> The plugging of components due to general corrosion could occur in the spray nozzles and flow orifices of the drywell and suppression chamber spray system. This aging mechanism and effect will apply since the spray nozzles and flow orifices are occasionally wetted, even though the majority of the time this system is on standby. The wetting and drying of these components can aid in the acceleration of this particular corrosion. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In BSEP LRA Section 3.2.2.2.7, the applicant states that suppression pool (torus) spray is not required for design basis accidents at BSEP, and is not considered a safety-related function. Drywell spray is required, but is not used in normal operation and is maintained isolated. Therefore, plugging or fouling of drywell spray components is not considered an applicable aging effect. Fouling of the ECCS strainers is managed by the protective coatings monitoring and maintenance program, which ensures that failed coatings in the primary containment will not degrade the capability of ECCS systems, including RHR and drywell spray, below design requirements.

The project team noted that SRP-LR Section 3.2.2.2.7 states that wetting and drying of components due to their occasional use can aid in the acceleration of general corrosion, which may result in plugging of components in the drywell spray system. The project team asked the applicant to clarify why plugging of drywell spray components is not an applicable aging effect.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that drywell spray is a safety-related function, but this post accident subsystem is not subject to alternate wetting either as a result of normal operation or periodic flow testing. Moreover, the portion of the drywell spray subsystem downstream of isolation valves is normally exposed to the inerted primary containment environment. Hence, significant accumulation of corrosion is not expected in the drywell spray header, and plugging or fouling of spray components is not considered to be an aging effect requiring aging management.

The project team reviewed and determined that the applicant's justification for concluding that plugging is not an applicable aging effect for drywell spray nozzles and orifices is acceptable on the basis that these components are not subjected to alternate wetting and drying; therefore,

they are not susceptible to corrosion product buildup, which could cause plugging.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.7 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3)..

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the GALL Report recommends further evaluation, the project team determines that the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.2.3 Aging Management Review Results That Are Not Consistent With the GALL Report or Are Not Addressed in the GALL Report

AMRs that are plant specific and are not consistent with the GALL Report, as identified in BSEP LRA Table 2s with generic Notes F through J, were reviewed by NRR DE staff and will be addressed in Section 3 of the BSEP LRA SER.

## 3.3 BSEP LRA Section 3.3 - Aging Management of Auxiliary Systems

In the BSEP LRA Section 3.3, the applicant provides the results of its AMRs for the auxiliary systems.

In the BSEP LRA Tables 3.3.2-1 through 3.3.2-25, the applicant provided a summary of the applicant's AMR results for components/commodities in the: (1)reactor water cleanup system; (2) reactor core isolation cooling system; (3) reactor building sampling system; (4) high post accident sampling system; (5) screen wash water system; (6) service water system; (7) reactor building closed cooling water system; (8) diesel generator system; (9) heat tracing system; (10) instrument air system; (11) pneumatic nitrogen system; (12) fire protection system; (13) fuel oil system; (14) radioactive floor drains system; (15) radioactive equipment drains system; (16) makeup water treatment system; (17) potable water system; (18) process radiation monitoring system; (19) liquid waste processing system; (20) fuel pool cooling and cleanup system; (21) HVAC diesel generator building; (22) HVAC reactor building; (23) torus drain system; (24)) civil structure auxiliary systems; and, (25) non-contaminated water drainage system.

The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the BSEP LRA Table 3.3.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in the BSEP LRA Table 3.3.1 those components that are consistent with the GALL Report where no further evaluation is required, those that are consistent with the GALL Report in which further evaluation is recommended, and those that are not addressed in the GALL Report together with the basis for their exclusion.

The project team conducted its audit and review in accordance with SRP-LR Section 3.3.3 and the BSEP audit and review plan plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

3.3.1 Aging Management Review Results That Are Consistent With the GALL Report

For AMRs that the applicant states are consistent with the GALL Report, the project team conducted its audit to determine if the applicant's references to the GALL Report in the BSEP LRA are acceptable.

The project team reviewed its assigned BSEP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the reactor water cleanup system, reactor core isolation cooling system, reactor building sampling system, high post accident sampling system, screen wash water system, service water system, reactor building closed cooling water system, diesel generator system, heat tracing system, instrument air system, pneumatic nitrogen system, fire protection system, fuel oil system, radioactive floor drains system, radioactive equipment drains system, makeup water treatment system, potable water system, process radiation monitoring system, liquid waste processing system, fuel pool cooling and cleanup system, HVAC diesel generator building, HVAC reactor building, torus drain system, civil structure auxiliary systems, and non-contaminated water drainage system components that are subject to an AMR.

3.3.1.1 Loss of Material for Circulating Water Pump Strainers in the Service Water System

In the discussion section of Table 3.3.2-6 in the BSEP LRA the applicant includes an AMR line item for strainers in the service water system that are constructed of copper alloy and exposed to raw water on their internal surface. The open-cycle cooling water system program (BSEP AMP B.2.7) is credited for managing loss of material due to crevice corrosion, pitting corrosion, and MIC. GALL Report item VII.C1.6-a is referenced, which evaluates strainers constructed of carbon steel and stainless steel. This GALL Report line item does not identify copper alloy as one of the materials evaluated. However, generic Note C is noted in the applicant's AMR, indicating consistency with the GALL Report except for the component. The project team asked the applicant why generic Note C was referenced for this AMR.

In its letter dated March 14, 2005 (ML050810493), the applicant provided the following explanation for this discrepancy:

> The strainers in question are circulating water pump cooling water strainers in scope for spatial interaction. The assignment of note C was a result of comparing these housings to GALL line item VII.C1.1-a (piping and fittings), which does include copper alloys in a raw water environment. As such, the appropriate GALL reference should be to VII.C1.1-a; not VII.C1.6-a. The service water basket strainers addressed elsewhere in Table 3.3.2-6, are referenced to GALL VII.C1.6-a, and correctly assigned note A.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.3.1.2 Loss of Material for Piping in the Instrument Air System

In the discussion section of Table 3.3.2-10 of the BSEP LRA the applicant includes an AMR line item for piping in the instrument air system that is constructed of carbon steel and exposed to indoor air on its internal surface. The one-time inspection program (BSEP AMP B.2.15) is credited for managing loss of material due to general corrosion for this component. GALL Report line item VII.D.1-a is referenced, which recommends the compressed air monitoring program (XI.M24) to manage this aging effect. The applicant's AMR indicates generic Note E, indicating consistency with GALL except for the AMP.

In comparing the AMP recommended in the GALL Report to the applicant's one-time inspection program, the project team noted that the AMP recommended in the GALL Report includes activities in addition to visual inspection for managing this aging effect, such as frequent leak testing of valves, piping, and other system components, and a preventive maintenance program to check air quality at several locations in the system. The applicant's program does not include these activities.

The project team asked the applicant to provide justification for concluding that the one-time inspection program is sufficient to manage aging for the piping identified in this AMR line item. In its response, the applicant provided the following explanation:

> In the BSEP LRA Table 3.3.2-10 for the instrument air system, the table line item for piping with indoor air (internal) and the one-time inspection AMP represents components that are in the instrument air system but are not in an instrument air or compressed air environment. The internal environment is indoor air. The components representing the line item are non safety-related piping downstream of relief valves connected to the safety-related nitrogen header and are shown on drawing D-73068-LR Sh 1. The GALL XI.M32 one-time inspection AMP is appropriate for the subject instrument air system piping components.
>
> As stated in the Draft 2005 GALL, a one-time inspection may be used to provide additional assurance that aging that has not yet manifested itself is not occurring, that the evidence of aging shows that the aging is so insignificant that an aging management program is not warranted. A one-time inspection may also trigger development of a program necessary to assure component intended functions through the period of extended operation. XI.M32 also states that there may be locations that are isolated from the flow stream for extended periods and are susceptible to the gradual accumulation or concentration of agents that promote certain aging effects. This program provides inspections that either verify that unacceptable degradation is not occurring or trigger additional actions that will assure the intended function of affected components will be maintained during the period of extended operation.
>
> In summary, the subject in-scope instrument air system components are not in an instrument air or a compressed air environment. Thus, a compressed air monitoring program would not be a good fit. Instead, the one-time inspection program was chosen. The use of the one-time inspection AMP is appropriate for the subject instrument air piping components.

The applicant also provided a copy of BSEP calculation BNP-LR-345, "License Renewal Aging Management Review - Pneumatic Systems (6135, 6152, 2055)," Rev. 1. The project team reviewed this document to confirm the application of the piping in question and the environment identified in the BSEP LRA for this component.

The project team reviewed and determined that, since the subject components are not in a compressed air environment, the compressed air program would not be appropriate for aging management. The one-time inspection program will provide inspections that either verify that unacceptable degradation is not occurring or trigger additional actions that will assure the intended function of affected components will be maintained during the period of extended operation. Therefore, the one-time inspection is an acceptable AMP to manage aging for these components.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.3.1.3 Loss of Material for Piping and Valves in the Heat Tracing System

In the discussion section of Table 3.3.2-9 in the BSEP LRA the applicant includes AMR line items for piping and valves in the heat tracing system that are constructed of carbon steel and exposed to treated water on their internal surface. The one-time inspection program (BSEP AMP B.2.15) is specified for managing loss of material due to corrosion for these components. Since the environment is treated water, the project team expected that the water chemistry program would also be credited. The project team asked the applicant to provide justification for not crediting the water chemistry program, in addition to the one-time inspection program, for aging management. In its response the applicant stated:

> The steam supplied to the heat tracing system from the auxiliary boiler can be classified as treated water. However, it is not appropriate to credit the water chemistry program to prevent aging of the heat tracing system piping. Auxiliary boiler water quality is not controlled to the same water chemistry requirements applicable to reactor feed water. The heat tracing system is used on a very infrequent basis. The one-time inspection program is considered to be the appropriate program to confirm the extent, if any, of age related degradation.

The project team reviewed and determined the applicant's response to be acceptable, on the basis that credit cannot be taken for the water chemistry program and a one-time inspection of this infrequently used system will determine the extent of degradation, if any, and any follow-up actions required, prior to entering the extended period of operation.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

Conclusion

On the basis of its audit and review, the project team reviewed and determined that for AMRs not requiring further evaluation, as identified in the BSEP LRA Table 3.3.1 (Table 1), the applicant's references to the GALL Report are acceptable and 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.3.2 Aging Management Review Results For Which Further Evaluation Is Recommended By the GALL Report

For some line-items assigned to the project team in the BSEP LRA Tables 3.3.2-1 through 3.3.2-25, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in BSEP LRA Section 3.3.2.2 against the criteria provided in the SRP-LR Section 3.3.3.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.3 citing the item in Table 1.

#### 3.3.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion (BSEP LRA Section 3.3.2.2.1)

##### 3.3.2.1.1 Spent Fuel Pool Cooling Heat Exchangers (BSEP LRA Section 3.3.2.2.1.1)

The project team reviewed BSEP LRA Section 3.3.2.2.1.1 against the criteria in SRP-LR Section 3.3.2.2.1.1, which states:

> Loss of material due to general, pitting, and crevice corrosion could occur in the channel head and access cover, tubes, and tubesheets of the heat exchanger in the spent fuel pool cooling and cleanup [system]. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI guidelines of BWRVIP-29 (TR-103515) for water chemistry in BWRs to manage the effects of loss of material from general, pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In BSEP LRA Section 3.3.2.2.1.1, the applicant states that the water chemistry program (BSEP AMP B.2.2) is used to manage aging effects/mechanisms that could occur on various heat exchanger components in the fuel pool cooling system that are exposed to treated water used as coolant for the fuel pools. The one-time inspection program (BSEP AMP B.2.15) will be used to verify the effectiveness of the water chemistry program for the management of corrosion for the surfaces of components normally exposed to the fuel pool treated water.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.1.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.2 Spent Fuel Pool Cooling Piping, Valves, Filters, and Ion Exchangers (BSEP LRA Section 3.3.2.2.1.2)

The project team reviewed BSEP LRA Section 3.3.2.2.1.2 against the criteria in SRP-LR Section 3.3.2.2.1.2, which states:

> Loss of material due to pitting and crevice corrosion could occur in the piping, filter housing, valve bodies, and shell and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI guidelines of BWRVIP-29 (TR-103515) for water chemistry in BWRs to manage the effects of loss of material from pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In BSEP LRA Section 3.3.2.2.1.2, the applicant states that the water chemistry program (BSEP AMP B.2.2) is used to manage aging effects/mechanisms that could occur on various components in the fuel pool cooling system that are exposed to treated water used as coolant for the fuel pools. The one-time inspection program (BSEP AMP B.2.15) will be used to verify the effectiveness of the water chemistry program for the management of corrosion for the surfaces of components normally exposed to the fuel pool treated water.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.1.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 Hardening and Cracking or Loss of Strength Due to Elastomer Degradation or Loss of Material Due to Wear (BSEP LRA Section 3.3.2.2.2)

The project team reviewed BSEP LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2, which states:

> Hardening and cracking due to elastomer degradation could occur in elastomer linings of the filter, valve, and ion exchangers in spent fuel pool cooling and cleanup systems. Hardening and loss of strength due to elastomer degradation could occur in the collars and seals of the duct and in the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating ventilation systems and

> in the collars and seals of the duct in the diesel generator building ventilation system. Loss of material due to wear could occur in the collars and seals of the duct in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

In BSEP LRA Section 3.3.2.2.2, the applicant states that the plant-specific systems monitoring program (BSEP AMP B.2.29) is used to manage aging effects/mechanisms for the external surfaces of elastomer components. The preventive maintenance program (BSEP AMP B.2.30) is used to manage aging effects/mechanisms for the internal surfaces of elastomer components for the emergency diesel generator building, reactor building, and control building ventilation systems. No valve elastomers requiring aging management have been identified in the fuel pool cooling system.

The project team reviewed and determined that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.2 for further evaluation. For those AMRs whose further evaluation is provided in BSEP LRA Section 3.3.2.2.2, the project team concluded that the applicant is consistent with the GALL Report and the AMRs are acceptable.

3.3.2.3 Cumulative Fatigue Damage (BSEP LRA Section 3.3.2.2.3)

Cumulative fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed in Section 4 of the SER related to the BSEP LRA and is reviewed by the NRR DE staff.

3.3.2.4 Crack Initiation and Growth Due to Cracking or Stress Corrosion Cracking (BSEP LRA Section 3.3.2.2.4)

The project team reviewed BSEP LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4, which states:

> Crack initiation and growth due to SCC could occur in the regenerative and non-regenerative heat exchanger components in the reactor water cleanup system of BWR plants. The GALL Report recommends further evaluation to ensure that these aging effects are managed adequately.

In BSEP LRA Section 3.3.2.2.4, the applicant states that, for the regenerative and non-regenerative heat exchangers in the reactor water cleanup system, this component group is not applicable to BSEP because only the carbon steel shells of the reactor water cleanup system heat exchangers have an intended function, and carbon steel is typically not subject to SCC.

The project team reviewed BSEP calculation BNP-LR-311, “License Renewal Aging Management Review, Reactor Water Cleanup System (2010),” Rev. 0, and confirmed that only the carbon steel shells of the regenerative heat exchangers have an intended function, and are in the scope of license renewal because they are the anchor in the pipe stress analyses associated with the safety-related/non safety-related boundary at valves 1-G31-F042 and 2-G31-F042. The carbon steel shells of the non-regenerative heat exchangers have no intended function, and are not within the scope of license renewal.

The project team concurred with the applicant's assessment that SCC does not apply to the carbon steel shell. Therefore, the project team concluded that the applicant's further evaluation is acceptable, on the basis that SRP-LR Section 3.3.2.2.4 is not applicable to BSEP.

3.3.2.5 Loss of Material Due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion (BSEP LRA Section 3.3.2.2.5)

The project team reviewed the BSEP LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5, which states:

> Loss of material due to general, pitting, and crevice corrosion could occur in the piping and filter housing and supports in the control room area, the auxiliary and radwaste area, the primary containment heating and ventilation systems; in the piping of the diesel generator building ventilation system, in the above ground piping, and fittings, valves, and pumps in the diesel fuel oil system and in the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the EDG system. Loss of material due to general, pitting, crevice and microbiologically influenced corrosion could occur in the duct fittings, access doors, and closure bolts, equipment frames and housing of the duct, due to pitting and crevice corrosion could occur in the heating/cooling coils of the air handler heating/cooling, and due to general corrosion could occur on the external surfaces of all carbon steel SCs, including bolting exposed to operating temperatures less than 212°F in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

In BSEP LRA Section 3.3.2.2.5, the applicant states that loss of material on the exterior surfaces of carbon steel components exposed to moist air will be managed using the systems monitoring program (BSEP AMP B.2.29) for those components with operating temperatures less than 212ºF. The one-time inspection program (BSEP AMP B.2.15) will confirm that aging is managed on the interior surfaces of those components that are exposed to moist air, but not subject to periodic inspection under the preventive maintenance program (BSEP AMP B.2.30).

The applicant states that the components described in BSEP LRA Section 3.3.2.2.5 as requiring aging management for loss of material are all constructed of carbon steel, with the exception of a drain valve in the control building HVAC system. The potential for loss of material due to crevice corrosion and pitting corrosion exists for the internal surface of this stainless steel valve located in the condensate drain piping of the control building HVAC system. The internal surface of this valve is normally in a moist air environment and is subject to periodic wetting. The condition of the valve will be confirmed by the one-time inspection program.

Section 3.3.2.2.5 of the BSEP LRA further states that the external surfaces of the plate coils within the penetration cooling system are normally concealed from view, such that routine visual inspection is not practical. These components will be managed with the preventive maintenance program.

Section 3.3.2.2.5 of the BSEP LRA further states that aging of both the exterior and interior surfaces of miscellaneous mechanical components associated with the control building, diesel

generator building, service water intake structure, and reactor buildings will be managed for loss of material using the preventive maintenance program. These include sump pump components and back flow valves. The project team noted that the description of the preventive maintenance program in Section B.2.30 of the BSEP LRA includes a table that identifies the components included in the program, and the reactor building is not listed in the line item associated with aging of sump pump components. The project team asked the applicant to explain this apparent discrepancy.

In its letter dated March 14, 2005 (ML050810493), the applicant provided the following explanation for this discrepancy:

> The table in the description of BSEP AMP B.2.30 is correct. The reactor building sump pumps are associated with the radioactive floor drains system and are subject to a one-time inspection. The further evaluation in Section 3.3.2.2.5 of the BSEP LRA should state '...aging of both the exterior and interior surfaces of miscellaneous mechanical components associated with the control building, diesel generator building, and service water intake structure will be managed for loss of material using the preventive maintenance program (BSEP AMP B.2.30)'.

The project team reviewed and determined the applicant's response acceptable on the basis that it clarifies the applicant's AMR for aging management of the reactor building sump pump components. The reactor building sump pumps are included in the radioactive floor drains system and the one-time inspection program will be used to manage aging, which is acceptable.

Section 3.3.2.2.5 of the BSEP LRA further states that aging of exterior surfaces of above ground carbon steel tanks associated with the fire protection system will be managed by the aboveground carbon steel tanks program.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.5 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.6 Loss of Material Due to General, Galvanic, Pitting, and Crevice Corrosion (BSEP LRA Section 3.3.2.2.6)

The project team reviewed the BSEP LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6, which states:

> Loss of material due to general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collection system in fire protection. The fire protection program relies on a combination of visual and volumetric examinations in accordance with the guidelines of 10 CFR Part 50 Appendix R and Branch Technical Position 9.5-1 to manage loss of material from corrosion. However, corrosion may occur at locations where water from wash downs may accumulate. Therefore, verification of the effectiveness of the program should be performed to ensure that corrosion is not occurring.

> The GALL Report recommends further evaluation of programs to manage loss of material due to general, galvanic, pitting, and crevice corrosion to verify the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the tank of the reactor coolant pump oil collection system is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In BSEP LRA Section 3.3.2.2.6, the applicant states that components in the reactor coolant pump oil collection fire protection system are not applicable to BSEP since BSEP is not designed with a reactor coolant pump oil collection system. The reactor coolant pumps are contained within the primary containment, which is inerted with nitrogen during normal operation.

The project team reviewed BSEP calculation BNP-LR-304, "License Renewal Aging Management Review - Specialty Area Summary for Auxiliary Systems," Rev. 0, and confirmed that BSEP is not designed with a reactor coolant pump oil collection fire protection system.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section3.3.2.2.6 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.7 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Biofouling (BSEP LRA Section 3.3.2.2.7)

The project team reviewed BSEP LRA Section 3.3.2.2.7 against the criteria in SRP-LR Section 3.3.2.2.7, which states:

> Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur on the internal surface of tanks in the diesel fuel oil system and due to general, pitting, and crevice corrosion and MIC in the tanks of the diesel fuel oil system in the EDG system. The existing BSEP AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D4057, D1796, D2709 and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. Verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion/biofouling to verify the effectiveness of the program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In BSEP LRA Section 3.3.2.2.7, the applicant states that the fuel oil chemistry program manages loss of material and fouling for all components wetted by fuel oil. This also includes the tank and other components supplying fuel to the diesel fire pump. The effectiveness of the fuel oil

chemistry program is confirmed by inspection of fuel oil tanks using the one-time inspection program.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.8 Quality Assurance for Aging Management of Non-Safety Related Components (BSEP LRA Section 3.3.2.2.8)

Quality assurance for aging management of non-safety related components is reviewed by NRR DIPM staff and addressed in the BSEP LRA SER.

3.3.2.9 Crack Initiation and Growth Due to Stress Corrosion Cracking and Cyclic Loading (BSEP LRA Section 3.3.2.2.9)

Applicable to PWR systems only.

3.3.2.10 Reduction of Neutron Absorbing Capacity and Loss of Material Due to General Corrosion (BSEP LRA Section 3.3.2.2.10)

The project team reviewed BSEP LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10, which states:

> Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

In BSEP LRA Section 3.3.2.2.10, the applicant states that the BSEP boral plates are sandwiched between the inner and outer wall of the rack tubes and are not subject to dislocation, deterioration, or removal. Plant-specific operating experience and testing results of BSEP boral sample stations have validated the absence of aging effects. Therefore, no aging management program is required for this commodity.

The project team reviewed the applicant's further evaluation and requested documentation of the test results that support the applicant's conclusion that no aging management program is required. The applicant provided a copy of BSEP Procedure Development Form for procedure 0PT-90.11, "Boral Surveillance Sample Testing," Rev. 9, 12/07/2000. BSEP issued this document to cancel the requirement to periodically test boral sample coupons based on test results that showed no significant aging of the boral in past tests. The project team reviewed Attachment 3 of this document, which included a summary of test results performed in 1989 and 1995. The boral plates were installed in 1984 as part of a spent fuel pool expansion, and boral coupons were tested in 1989 and 1995 to monitor degradation of the boral. The results of the tests showed little change of the coupons from their original condition in 1984. Based on these results, the applicant concluded that further testing was not warranted. The project team's

review of the test results supports this conclusion.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.11 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion (BSEP LRA Section 3.3.2.2.11)

The project team reviewed BSEP LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11, which states:

> Loss of material due to general, pitting, and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system (SW system) and in the diesel fuel oil system. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

In BSEP LRA Section 3.3.2.2.11, the applicant states that the buried piping and tanks inspection program (BSEP AMP B.2.17) will be used for managing loss of material for buried components of the service water and diesel fuel oil systems. The program relies on industry practice and operating experience to manage the effects of loss of material from exterior corrosion.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.11 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the GALL Report recommends further evaluation, the project team determines that the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3 Aging Management Review Results That Are Not Consistent With the GALL Report or Are Not Addressed in the GALL Report

AMRs that are plant specific and are not consistent with the GALL Report, as identified in BSEP

LRA Table 2s with generic Notes F through J, were reviewed by NRR DE staff and will be addressed in Section 3 of the BSEP LRA SER.

### 3.4 BSEP LRA Section 3.4 - Aging Management of Steam and Power Conversion Systems

In the BSEP LRA Section 3.4, the applicant provided the results of its AMRs for the steam and power conversion systems.

In the BSEP LRA Tables 3.4.2-1 through 3.4.2-7, the applicant provides a summary of the applicant's AMRs results for components/commodities in the: (1) main steam; (2) auxiliary boiler; (3) feedwater; (4) heater drains and miscellaneous vents and drains; (5) condensate; (6) turbine building sampling; and, (7) main condenser gas removal systems.

The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the BSEP LRA Table 3.4.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in the BSEP LRA Table 3.4.1 those components that are consistent with the GALL Report where no further evaluation is required, those that are consistent with the GALL Report in which further evaluation is recommended, and those that are not addressed in the GALL Report together with the basis for their exclusion.

The project team conducted its audit and review in accordance with SRP-LR Section 3.4.3 and the BSEP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

#### 3.4.1 Aging Management Review Results That Are Consistent With the GALL Report

For AMRs that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's references to the GALL Report in the BSEP LRA are acceptable.

The project team reviewed its assigned BSEP LRA line-items to determine that the applicant: (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the main steam, auxiliary boiler, feedwater, heater drains and miscellaneous vents and drains, condensate, turbine building sampling, and main condenser gas removal systems components that are subject to an AMR.

##### 3.4.1.1 Loss of Material for Closure Bolting in High Temperature and Pressure Systems

In the discussion section of BSEP LRA Table 3.4.1, item number 3.4.1-08, the applicant addresses aging management of closure bolting in the steam and power conversion system. The applicant states that the BSEP bolting integrity program (BSEP AMP B.2.6) is not applicable since this system does not use high strength pressure boundary bolting. For non-Class 1 closure bolting, the applicant considers bolting to be a subcomponent of the associated component; therefore, bolting materials are not itemized as a separate component and the bolting integrity program is not needed for aging management.

During the audit and review the project team reviewed BSEP LRA Tables 3.4.2-1 through 3.4.2-7 and noted that the AMR line items for the steam and power conversion systems specify the systems monitoring program (BSEP AMP B.2.29) for visual inspection of the external surfaces of components, including any bolting associated with the component, to identify general corrosion. However, this AMP does not address the crack initiation and growth aging effect for pressure retaining bolting. The GALL Report recommends the bolting integrity program (GALL AMP XI.M18) to manage loss of material due to general corrosion, and crack initiation and growth due to cyclic loading and/or SCC for all closure bolting in high-pressure or high-temperature systems that is in the scope of license renewal. The GALL Report AMP does not exclude non-Class 1 bolting.

The project team reviewed the BSEP bolting integrity program (BSEP AMP B.2.6), and its evaluation is documented in Section 2.6 of this audit report. It was noted that the BSEP bolting integrity program is claimed to be consistent with GALL AMP XI.M18; however, it has several major exceptions. For non-Class 1 pressure retaining bolting, the BSEP AMP excludes the ASME Section XI inservice inspection activities, along with monitoring and trending under the systems monitoring program.

This discrepancy was identified as part of the project team's audit of the ESF systems. The project team requested that the applicant clarify how aging management of pressure retaining bolting would be managed during the extended period of operation. In response, the applicant committed to revise the bolting integrity program to include non-Class 1 pressure retaining bolting. In addition, the applicant committed to revise each applicable section of the BSEP LRA, including Section 3.4 on the steam and power conversion systems, to reflect this change in scope of the bolting integrity program and address each of the aging effects identified in the GALL Report. The applicant's response and the project team's evaluation are discussed in Section 3.2.1.1 of this audit report.

The project team reviewed and determined that, upon completion of the revisions noted above, the bolting integrity program will be consistent with the GALL Report for all pressure retaining bolting. Structural bolting will not be addressed. Since BSEP treats bolting as a subcomponent of the pressure-retaining components, there are no separate AMRs for bolting in the steam and power conversion systems. However, the applicants commitment to specify the bolting integrity program to manage all of the aging effects identified in the GALL Report for components containing Class 1 and non-Class 1 pressure retaining bolting will resolve the above mentioned discrepancy.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.4.1.2 Loss of Material and Buildup of Deposits for Heat Exchangers, Coolers, and Condensers Serviced by Open-Cycle Cooling Water

In the discussion of BSEP LRA Table 3.4.1, item number 3.4.1-09, the applicant addresses loss of material due to corrosion and buildup of deposits due to biofouling for heat exchangers, coolers, and condensers serviced by open-cycle cooling water. The GALL Report recommends the open-cycle cooling water system program to manage these aging effects. However, the applicant states that management of these aging effects is not applicable to BSEP since the main condensers' pressure boundary integrity is continuously confirmed through normal plant

operation. Therefore, the open-cycle cooling water system program is not credited for managing aging effects/mechanisms for the main condensers.

As part of its AMR audit for the main condensers, the project team asked the applicant to justify its conclusion that no aging management program was required for these components. In response, the applicant stated that intended function M-1, provide pressure-retaining boundary, was inappropriate for the main condenser and the BSEP LRA will be revised to reflect this. The applicants response and the project team's evaluation are discussed in Section 3.4.1.5 of this audit report.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.4.1.3 Loss of Material for Heat Exchangers, Coolers, and Condensers Serviced by Closed-Cycle Cooling Water

In the discussion section of BSEP LRA Table 3.4.1, item number 3.4.1-10, the applicant addresses loss of material due to corrosion for heat exchangers, coolers and condensers that are serviced by closed-cycle cooling water. The applicant states that item number 3.4.1-10 is not applicable to BSEP, since there are no heat exchangers and cooler/condensers serviced by closed-cycle cooling water. The project team concurred with the applicant's determination that the aging effects addressed by this item number are not applicable on the basis that the BSEP plant design eliminates any closed-cycle cooling water system components from the steam and power conversion systems.

3.4.1.4 Loss of Material for Piping and Fittings, and Valves in the Auxiliary Boiler System

In the discussion section of Table 3.4.2-2 in the BSEP LRA the applicant includes AMR line items for piping and fittings, and valves in the auxiliary boiler system that are constructed of carbon steel and exposed to treated water. The one-time inspection program (BSEP AMP B.2.15) is specified to manage loss of material due to crevice, general, and pitting corrosion for these components. GALL Report line item VIII.B2.1-a is referenced for the piping and fittings AMR, and VIII.B2.2-b is referenced for the valve AMR. However, both of the GALL Report line items referenced recommend the water chemistry program (GALL AMP XI.M2) to manage these aging effects.

The project team evaluated the applicant's use of the one-time inspection program as an alternative to the water chemistry program for managing the aging effects identified for the auxiliary boiler system. Through interviews with the BSEP staff, the project team reviewed and determined that, although corrosion inhibitors are added to the water in the auxiliary boiler, the subject piping and valves are not under constant water chemistry control. The one-time inspection program in the GALL Report (GALL AMP XI.M32) states:

> There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, or (b) an aging effect is expected to progress very slowly. For these cases, there is to be confirmation that either the aging effect is indeed not occurring, or the aging effect is occurring very slowly as not to affect the component or structure intended function. A one-time inspection of the subject component or structure is an acceptable option for

this verification. One-time inspection is to provide additional assurance that either aging is not occurring or the evidence of aging is so insignificant that an aging management program is not warranted.

The project team also reviewed BSEP operating procedure 0OP-40, "Auxiliary Steam System," Revision 59, and BSEP Nuclear Generation Group calculation No. BNP-LR-327, "Condensate Systems (3070, 3077, 3080, 4005, 4010)." Based on the review of these documents, the project team reviewed and determined that the auxiliary steam system is operated infrequently, and there may be locations that are isolated from the flow stream for extended periods, or are susceptible to the gradual accumulation and concentration of agents that promote certain aging effects. The one-time inspection program provides inspections that either verify the absence of aging degradation or trigger additional actions that will assure the intended function of affected components will be maintained during the period of extended operation.

The project team reviewed and determined that, since the GALL Report identifies the one-time inspection program as an acceptable method for verifying the lack of an aging effect, or a slowly progressing aging effect, this AMP is acceptable for managing the aging effects for the auxiliary boiler system components.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.4.1.5 Loss of Material for the Main Condenser in the Condensate System

In the discussion section of BSEP LRA Table 3.4.2-5, the applicant presents its AMR results for the main condenser system. Under the table subheading "Main Condenser", on page 3.4-33 of the BSEP LRA, the applicant claims consistency with the GALL Report for aging management of the internal and external surfaces of the carbon steel condenser shell. Generic Note E is cited (component, material, environment consistent, different AMP). However, the applicant claims that an AMP is not applicable, and references plant-specific Note 404. The project team noted that the applicant's use of Note E for these AMR entries is questionable, because no AMP is credited.

The applicant's justification for not specifying an aging management program for these components is provided in plant-specific Note 404, which states that the integrity of the main condenser required to perform its post-accident intended function is continuously confirmed by normal plant operation; therefore, no traditional aging management program is required. The post-accident intended function of the main condensers is to provide a holdup volume and plateout surface for MSIV leakage. This intended function does not require the main condensers to be leak-tight, since the post-accident conditions in the main condensers are essentially atmospheric. Under post-accident conditions, there will be no challenge to the pressure boundary integrity of the main condensers. Since normal plant operation assures adequate main condenser pressure boundary integrity, the post-accident intended function to provide pressure boundary and holdup volume and plateout surface is assured.

During the audit and review the project team evaluated the applicant's justification and noted that SRP-LR Appendix A, Section A.1.2.3.4, states that a program based solely on detecting structure and component failures is not considered an effective aging management program. The project team requested that the applicant justify why monitoring main condenser integrity

during normal plant operation is adequate as the only aging management program for ensuring intended functions identified, which are M-1, provide pressure-retaining boundary, and M-7, provide post-accident containment, holdup, and plateout of MSIV bypass leakage.

In its letter dated March 14, 2005 (ML050810493), the applicant stated that the main condensers were placed in the scope of license renewal due to application of the alternate source term requirement. The applicant inadvertently assigned intended function M-1 to the main condensers and its associated components. The intended function M-7, which provides holdup and plateout of MSIV leakage, is the appropriate function for the main condensers in the alternate source term role; whereas, M-1 (pressure boundary) is not an appropriate intended function. BSEP LRA Table 2.3.4-5 and Table 3.4.2-5 will be revised to show that the main condenser tubes, tube sheet, shell and associated components have an intended function of M-7 only. The applicant also will revise BSEP LRA Table 3.4.1 Item Numbers 3.4.1-05 and 3.4.1-09, and BSEP LRA Subsection 3.4.2.2.4 by removing reference to the pressure boundary function of the main condenser. Additionally, the applicant will revise plant-specific Note 404 to remove the discussion of the pressure boundary function of the main condenser, and it will read as follows:

> Aging management of the Main Condensers is not based on analysis of materials, environments and aging effects. Materials, environments, and aging effects were evaluated, however no traditional aging management program is require. The Main Condenser is required to perform a post-accident intended function of holdup and plateout of MSIV leakage (M-7), and this function is continuously confirmed by normal plant operation. The M-7 intended function does not require the Main Condensers to be leak-tight, with the post-accident conditions in the Main Condenser essentially atmospheric. In maintaining vacuum, the Main Condenser proves its integrity continuously as a vital component of continued plant operation. Normal plant operation continuously monitors the integrity of the Main Condenser which provides assurance that the Main Condenser would be able to perform a post-accident intended function of holdup and plateout of MSIV leakage.

Based on the applicant's statement that the only intended function for the main condensers is M-7, to provide post-accident containment, holdup, and plateout of MSIV bypass leakage, the project team concurs with the applicant's determination that the main condenser does not have to be leak-tight, since the post-accident conditions in the main condenser are essentially atmospheric. During normal plant operations, condenser vacuum is continuously monitored, which verifies the integrity of the main condenser. If the integrity of the main condenser were to degrade to a point where a loss of vacuum occurred, this would require placing the plant in a mode where the M-7 intended function would be obviated. Therefore, acceptable performance during normal plant operation provides adequate assurance that the main condenser can perform the holdup and plate-out post-accident function.

The project team concluded that, upon completion of the revisions identified above, item number 3.4.1-02 in BSEP LRA Table 3.4.1, and the Table 2 AMR line items for intended function M-7 that reference it will be consistent with the GALL Report and are acceptable.

The NRC DSSA staff will review the applicant's proposed deletion of the M-1 pressure boundary intended function for the main condensers. The results of this review will be documented in

Section 2.0 of the SER associated with the BSEP LRA.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

Conclusion

On the basis of its audit and review, the project team reviewed and determined that for AMRs not requiring further evaluation, as identified in the BSEP LRA Table 3.4.1 (Table 1), the applicant's references to the GALL Report are acceptable and 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2 Aging Management Review Results For Which Further Evaluation Is Recommended By The GALL Report

For some line-items assigned to the project team in the BSEP LRA Tables 3.4.2-1 through 3.4.2-7, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in BSEP LRA Section 3.4.2.2 against the criteria provided in the SRP-LR Section 3.4.3.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.4 citing the item in Table 1.

3.4.2.1 Cumulative Fatigue Damage (BSEP LRA Section 3.4.2.2.1)

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the BSEP LRA.

3.4.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion (BSEP LRA Section 3.4.2.2.2 )

The project team reviewed the BSEP LRA Section 3.4.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2, which states.

> The management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components and for loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The water chemistry program relies on monitoring and control of water chemistry based on the guidelines in EPRI guideline TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of

programs to manage loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In BSEP LRA Section 3.4.2.2.2, the applicant states that loss of material for carbon and stainless steel components in steam and power conversion systems (except for main steam system components) is managed by the water chemistry program (BSEP AMP B.2.2). Also, to verify the efficacy of that program, a one-time inspection of selected components and susceptible locations will be performed.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3 Local Loss of Material Due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling ( BSEP LRA Section 3.4.2.2.3)

Applicable to PWR auxiliary feedwater systems only.

3.4.2.4 General Corrosion (BSEP LRA Section 3.4.2.2.4)

The project team reviewed BSEP LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4, which states:

> Loss of material due to general corrosion could occur on the external surfaces of all carbon steel strictures and components, including closure boltings, exposed to operating temperature less that 212EF. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

In BSEP LRA Section 3.4.2.2.4, the applicant states that loss of material for steel components, including closure bolting, in steam and power conversion systems due to general corrosion on external surfaces that are exposed to operating temperatures less than 212EF, is managed by the plant-specific systems monitoring program. Management of aging effects/mechanisms associated with the main condensers is not applicable as the pressure boundary integrity of the main condensers is continuously confirmed through normal plant operations.

As discussed in this audit and review report, the applicant stated it will revise BSEP LRA Section 3.4.2.2.4 to eliminate the reference to the pressure boundary function of the main condensers since this function is inappropriate for these components. Also, as discussed in Section 3.2.1.1 of this audit report, the applicant stated that the bolting integrity program will be revised to include non-Class 1 pressure retaining bolting, and the applicable BSEP LRA sections will be revised to reflect the change in scope of the AMP and to address all of the aging effects

identified in the GALL Report for pressure retaining bolting.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.4 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.5 Loss of Material due to General, Pitting, and Microbiologically Influenced Corrosion (BSEP LRA Section 3.4.2.2.5)

3.4.2.5.1 PWR Auxiliary Feedwater System Lube Oil Coolers (BSEP LRA Section 3.4.2.2.5.1)

Applicable to PWR auxiliary feedwater systems only.

3.4.2.5.2 Buried Components (BSEP LRA Section 3.4.2.2.5.2)

Not applicable at BSEP since AFW is a PWR system.

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the GALL Report recommends further evaluation, the project team determines that the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Aging Management Review Results That Are Not Consistent With the GALL Report or Are Not Addressed in the GALL Report

AMRs that are plant specific and are not consistent with the GALL Report, as identified in BSEP LRA Table 2s with generic Notes F through J, were reviewed by NRR DE staff and will be addressed in Section 3 of the SER related to the BSEP LRA.

3.5 BSEP LRA Section 3.5 - Aging Management of Containments, Structures, and Component Supports

In the BSEP LRA Section 3.5, the applicant provided the results of its AMRs for containments, structures, and component supports.

In the BSEP LRA Tables 3.5.2-1 through 3.5.2-15, the applicant provided a summary of the AMRs results for components/commodities in the: (1) primary containment; (2) intake and discharge canals; (3) refueling system; (4) switchyard and transformer yard structures; (5) bridge cranes; (6) gantry cranes; (7) service water intake structure; (8) reactor building; (9) augmented off-gas building; (10) diesel generator building; (11) control building; (12) turbine building; (13) radwaste building; (14) water treatment building; and (15) miscellaneous structures and out-buildings.

The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the BSEP LRA Table 3.5.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in the BSEP LRA Table 3.5.1 those components that are consistent with the GALL Report, those that are consistent with the GALL Report in which further evaluation is recommended, and those that are not addressed in the GALL Report together with the basis for their exclusion.

The project team conducted its audit and review in accordance with SRP-LR Section 3.5.3 and the BSEP audit plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

3.5.1 Aging Management Review Results That Are Consistent With the GALL Report

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the BSEP LRA is acceptable.

The project team reviewed its assigned BSEP LRA line-items to determine that the applicant: (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the primary containment, intake and discharge canals, refueling system, switchyard and transformer yard structures, bridge cranes, gantry cranes, service water intake structure, reactor building, augmented off-gas building, diesel generator building, control building, turbine building, radwaste building, water treatment building, and miscellaneous structures and out-buildings components that are subject to an AMR.

3.5.1.1 Loss of Material due to Wear and Corrosion for Rails in Load Handling Systems

Tables 3.5.2-3, 3.5.2-5, and 3.5.2-6 in the BSEP LRA each include an AMR line item for loss of material due to wear for rails in load handling systems. The AMRs reference GALL Report line item VII.B.2-a, Table 1 item 3.3.1-16, and generic Note A. The project team noted that GALL Report line item VII.B.2-a lists a specific grade of corrosion-resistant steel (ASTM A759) commonly used for crane rails. The applicant's AMRs identify the material as "carbon steel." The project team noted that carbon steel would also be susceptible to loss of material due to corrosion. The project team asked the applicant to confirm that the crane rail material used at BSEP is grade A759 or equivalent. In its response the applicant confirmed that the crane rail material used at BSEP for the reactor building crane and the intake structure gantry crane meets the specifications for grade A759 crane rail steel. The crane rail material used at BSEP for the refueling platform meets the specifications for ASTM A1, which is a corrosion-resistant steel commonly used in railroad applications and is considered equivalent to A-759. On this basis, the project team concluded that the crane rail materials used at BSEP are consistent with the material specified in the GALL Report.

The project team also noted that in BSEP LRA Table 3.5.2-6, the AMR line item for the rails of the intake structure gantry crane identifies the environment as "exposed to weather". GALL line item VII.B.2-a lists the environment as "air at 100% relative humidity and 49ºC (120ºF)", which is

representative of design conditions inside containment. The project team also asked the applicant to provide its technical basis for concluding that the rails of the intake structure gantry crane in an “exposed to weather” environment are not susceptible to loss of material due to corrosion. In its response, the applicant stated that grade A759 crane rail steel has a long history of outdoor use without significant corrosion. In addition, BSEP’s operating experience review has not identified corrosion as an issue for crane rails. The project team concurs with the applicant’s assessment that corrosion is not a concern for A759 exposed to weather.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.5.1.2 Fretting and Lock Up Due to Wear for Drywell Head and Downcomer Pipes

BSEP LRA Table 3.5.1, Item 3.5.1-19, identifies steel elements: drywell head and downcomer pipes; fretting and lock up due to wear as the aging effect/mechanism; and containment ISI as the AMP. In the discussion column for item 3.5.1-19 in BSEP LRA Table 3.5.1, the applicant states:

> During normal operating conditions, the Primary Containment Drywell Head and Downcomers are not in contact with other components that could expose them to wear. However, during refueling operations, rubbing contact is possible during removal and reinstallation of the Drywell Head. Drywell Head movement is strictly controlled by procedure; therefore, loss of material due to wear is considered to be negligible.

The project team noted that there are no AMR entries in BSEP LRA Table 3.5.2-1 (containment) that reference BSEP LRA Table 3.5.1, item 3.5.1-19. The project team asked the applicant to provide its AMR results for this component/aging effect combination, and to address whether BSEP AMP B.2.18 (IWE) is credited for aging management of fretting and lock-up due to wear.

In its response, the applicant stated that

> All items in Table 3.5.1 were addressed in the BSEP LRA and an explanation provided in the discussion section, regardless of whether the aging effect was considered applicable. The discussion associated with item 3.5.1-19 explains the effect is considered negligible and that is why it was not addressed within Table 3.5.2-1.
>
> Although the IWE program is not credited for management of "fretting and lock-up due to wear" for the subject components; it is credited for "Loss of Material", which effectively envelops wear. As such, management of the subject components by IWE is considered sufficient.

The project team concurs that the applicant’s IWE program will provide adequate aging management of fretting and lock-up due to wear for the drywell head and downcomer pipes, and determined that the applicant’s response is acceptable.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

Conclusion

On the basis of its audit and review, the project team reviewed and determined that for AMRs not requiring further evaluation, as identified in the BSEP LRA Table 3.5.1 (Table 1), the applicant's references to the GALL Report are acceptable and 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2 Aging Management Review Results For Which Further Evaluation Is Recommended By the GALL Report

For some line-items assigned to the project team in the BSEP LRA Tables 3.5.2-1 through 3.5.2-15, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in BSEP LRA Section 3.5.2.2 against the criteria provided in the SRP-LR Section 3.5.3.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.5 citing the item in Table 1.

3.5.2.1 PWR and BWR Containments (BSEP LRA Section 3.5.2.2.1)

3.5.2.1.1 Aging of Inaccessible Concrete (BSEP LRA Section 3.5.2.2.1.1)

The project team reviewed BSEP LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1, which states:

> Cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack; and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in inaccessible areas of PWR concrete and steel containments; BWR Mark II concrete containments; and Mark III concrete and steel containments. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In BSEP LRA Section 3.5.2.2.1.1, the applicant states that the aging mechanisms of leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel are not significant for the concrete components of the primary containment structure. The BSEP primary containment is completely contained within the reactor building; therefore, it is not subject to aging effects associated with a below-grade, exterior environment. The primary containment concrete is not exposed to an aggressive environment and has been designed in accordance with ACI 318, with a low water/cement ratio and entrained air between 3 and 6%. Therefore, the aging mechanism of leaching of calcium hydroxide, which becomes significant only if the concrete is subject to flowing water, is not applicable. Also, aggressive chemical attack and corrosion of embedded steel are not applicable because the concrete is not exposed to aggressive chemicals.

The project team noted that the BSEP Mark I concrete containment design is unique. However,

similar to Mark I steel containments, it is completely enclosed by the reactor building, and is protected from the adverse environments that potentially cause age-related degradation of inaccessible concrete.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.2 Cracking, Distortion, and Increase in Component Stress Level Due to Settlement; Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundations, if Not Covered by Structures Monitoring Program (BSEP LRA Section 3.5.2.2.1.2)

The project team reviewed BSEP LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2, which states:

> Cracking, distortion, and increase in component stress level due to settlement could occur in PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments. Also, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

In BSEP LRA Section 3.5.2.2.1.2, the applicant states that settlement was monitored during construction of BSEP, and the predicted settlement values were found to be consistent with that actually experienced. Plant engineers monitor for the effects of differential settlement during inspections of structures under the structures monitoring program. A review of plant operating history has not identified any settlement issues. BSEP structures do not have porous concrete subfoundations, and BSEP does not employ a de-watering system. Furthermore, the primary containment concrete is not in contact with the soil or groundwater. Therefore, reduction of foundation strength due to erosion of porous concrete is not an applicable aging effect.

The project team reviewed and determined the applicant's further evaluation that the effects of differential settlement of BSEP structures is monitored during inspections under the structures monitoring program; BSEP does not have porous concrete subfoundations; and BSEP does not employ a de-watering system.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.5.2.1.3 Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature (BSEP LRA Section 3.5.2.2.1.3)

The project team reviewed BSEP LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3, which states:

> Reduction of strength and modulus of elasticity due to elevated temperatures could occur in PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments. The GALL Report recommends further evaluation if any portion of the concrete containment components exceeds specified temperature limits, i.e., general area temperature 66°C (150°F) and local area temperature 93°C (200°F).

In BSEP LRA Section 3.5.2.2.1.3, the applicant states that elevated temperatures above the limits specified in The GALL Report are not applicable for concrete structures and components outside the primary containment. Inside the primary containment structure, the bulk average temperature is less than 150°F; however, data for the confined, upper elevations of the primary containment have identified a maximum average temperature of 194°F. Based on an evaluation of drywell temperatures, the contact temperature at the inside face of the concrete (drywell side) is approximately 175°F and the contact temperature at the outside face of the concrete (Reactor Building side) is approximately 107°F. Because the elevated temperatures are localized to the confined upper elevation of the drywell and the actual concrete temperatures are on a gradient through the drywell wall, the upper elevation of the drywell is considered a local rather than a general area. Therefore, the containment concrete elements are exposed to temperatures consistent with the guidance provided in The GALL Report, which defines elevated temperatures as greater than 150°F general and 200°F local; and the primary containment concrete is not subject to degradation due to elevated temperature.

The project team requested that the applicant provide the detailed technical basis for this conclusion, including the results of heat transfer and thermal stress analyses, if available. In its response, the applicant stated:

> The BSEP containment bulk average temperature is maintained below 150°F and is managed by Technical Specifications Section 3.6.1.4, which require the plant enter LCO actions if the drywell bulk average temperature exceeds 150°F.
>
> The geometry of the BSEP drywell is such that the confined upper elevations will experience temperatures in excess of 150°F. However the increased temperatures are only present in the very upper regions of the drywell; as such only the pressure boundary concrete walls, as discussed in GALL Chapter II, of the drywell are subject to the higher temperatures. Plant specific note 536 was provided to explain this condition. The interior containment concrete addressed under GALL item III.A4.1-c is below the area of increased temperature and therefore not subject to the elevated temperatures, which is why plant specific note 513 is only associated with the interior concrete of GALL Chapter III.A4.
>
> A technical evaluation of the temperature gradient through the drywell wall determined interior concrete temperatures based on varying values of ambient drywell temperatures.

Based on the results of that evaluation, using the maximum upper drywell ambient air temperature of 194°F (based on local monitoring), the concrete surface temperature is approximately 175°F. The temperature gradient through the drywell wall was determined to be approximately 68°F. Based on the temperature gradient of 68°F and a drywell wall thickness of four feet, the internal concrete temperature would fall below 150°F approximately 18 inches from the inside surface of the drywell wall. The concrete contact temperature of 175°F in the upper elevations is well below the "local" areas temperature limit of 200°F and drops off to a contact temperature of 150°F within twenty feet of the upper elevations.

ACI 349 provides no basis for how local areas are defined and only provides the following statement for guidance: "such as around penetrations". The drywell concrete subject to temperatures in excess of 150°F is limited to less than half the wall thickness and is confined to the very upper elevations. The basis for "local" consideration is the fact that only a limited portion of the concrete cross-section is subject to temperatures over 150°F, not the entire section, which is similar to the temperature gradient surrounding a penetration. As such, the very upper elevations of the drywell would effectively mimic a large penetration and would therefore be categorized as a local area.

However, the drywell concrete has been evaluated for the effects of increased temperature and was found to be acceptable. The evaluation considered drywell concrete temperature to be 185°F with a linear temperature gradient between the interior and exterior surfaces of approximately 70°F.

Summary of the evaluation results are as follows:

The states of stress in liner, rebar and concrete are well within allowables for the normal operating condition and are not significantly different for the design accident conditions.

Reductions in strength and modulus may occur at elevated temperature and can conservatively be accounted for by reduction factors on allowable stresses. The physical state
of the concrete at 175°F to 185°F will not be significantly different from the ASME code limit 150°F.

There is no compromise of the containment's integrity under design accident conditions.

The project team reviewed the applicant’s response and determined that any reduction in strength and modulus of concrete resulting from sustained temperatures between 150ºF and 175ºF in the localized area of concrete at the upper elevation of the drywell would be minimal, and will not compromise the structural integrity of the containment structure under design accident conditions. The project team noted that the concrete area in question is inaccessible for inspection because it is behind the steel liner. Therefore, the applicant appropriately addressed this condition by analysis.

The project team further determined that, assuming complete loss of concrete strength in this localized area, the steel liner alone is capable of resisting the design accident pressure, although no credit is taken for it in the containment design. In addition, the capacity of the containment structure to resist seismic loading would be unaffected because the maximum seismic loads

occur at the base of the containment structure and are minimum at the top.

Therefore, the project team concluded that the applicant's further evaluation of the elevated temperature condition at the upper elevation of containment is acceptable.

The project team noted that the applicant does not address penetrations through the containment and reactor building concrete for the main steam and feedwater lines in BSEP LRA Section 3.5.2.2.1.3. The concrete surrounding these penetrations needs to be maintained below 200 ºF during normal operation to prevent long-term degradation. The project team requested that the applicant provide its AMR results for the concrete surrounding these, and any other penetrations for hot piping, and, if insulation and/or a penetration cooling system is credited for maintaining acceptable temperatures, to provide the AMR results for these items.

The applicant stated that the concrete surrounding the subject penetrations is addressed under "Concrete above grade" in BSEP LRA table 3.5.2-1. The specific aging effect associated with elevated temperature is addressed by GALL item number II.B2.2.1-g within the "Concrete above grade" group. The commodity "Insulation", within Table 3.5.2-1 is credited with maintaining the penetration temperatures below the local limits of 200°F.

In its response the applicant further stated that hot penetration temperatures, recorded on chart paper, were reviewed back to 1997. No penetration temperatures exceeded 200ºF, with the highest recorded temperature of 185 ºF, occurring between June 2003 and August 2003 on one of the main steam lines. As such, the insulation has been proven effective in maintaining hot penetration temperatures below 200 ºF.

The project team concluded that the applicant's further evaluation of hot piping penetrations is acceptable on the basis that the applicant: has described BSEP operating experience; has identified that insulation is credited with maintaining the penetration temperatures below the local limits of 200 ºF; and, has indicated that insulation is included in the LR scope and is subject to an AMR. The project team noted that the applicant's AMR for insulation is plant-specific, and is being reviewed by the DE staff and will be documented in Section 3 of the BSEP LRA SER.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.3 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.4 Loss of Material Due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate (BSEP LRA Section 3.5.2.2.1.4)

The project team reviewed BSEP LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4, which states:

> Loss of material due to corrosion could occur in inaccessible areas of the steel containment shell or the steel liner plate for all types of PWR and BWR containments. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In BSEP LRA Section 3.5.2.2.1.4, the applicant states that loss of material due to corrosion in inaccessible areas (embedded containment steel shell or liner) is not significant because:

- The Primary Containment concrete structure was designed to ACI 318 and was constructed in accordance with ACI 301. The low water-cement ratio and an air entrainment between 3 and 6% provides a dense concrete with a low permeability, which meets the intent of ACI 201.2R.
- 
- The concrete is monitored by the structures monitoring program to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment liner.
- 
- The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with IWE requirements.

- The above moisture barrier at the drywell liner and concrete containment floor interface has been designed to direct water away from the drywell liner. The containment concrete floor is sloped away from the drywell liner for drainage purposes. Periodic inspections of the concrete floor surface condition performed in accordance with the structures monitoring program will validate the continued absence of corrosion for the inaccessible portions of the drywell liner.

The project team reviewed and determined that the applicant satisfies the specific criteria defined in the GALL Report for preventing loss of material due to corrosion in inaccessible areas of the steel liner. However, the applicant does not address plant-specific operating experience in BSEP LRA Section 3.5.2.2.1.41. The project team requested that the applicant provide details of the plant-specific operating experience for this aging effect/mechanism. If loss of material due to corrosion has occurred, the project team asked the applicant to describe the corrective actions taken to prevent future occurrences, to describe any augmented inspection of the concrete floor and/or the moisture barrier that is currently conducted (e.g., inspection every outage), and to describe any augmented inspection that is credited for the extended period of operation.

In its response the applicant stated that degradation of the drywell liner, at the intersection of the concrete floor and moisture barrier, was identified in 1993. The degradation was extensively evaluated and weld repairs were performed in several areas. To minimize recurring corrosion, this area of the liner was re-coated with an epoxy coating and an enhanced moisture seal was installed in the expansion joint between the liner plate and the concrete floor that redirects any water in the vicinity away from the liner. Since the revised moisture barrier has been installed, no liner degradation has been identified; minor separation of the moisture barrier to the liner has been identified and repaired.

The applicant further stated that, based on Relief Request CIP-01, the moisture barriers are inspected once each Inspection period ( i.e., three examinations in a ten year period) via a general visual examination. The IWE inspection for the moisture barrier lists the following for recordable conditions: wear, damage, erosion, tear, surface cracks, or other defects that may violate the leak-tight integrity; and moisture barrier separation at the interface to the liner and/or concrete. Specific instructions under acceptance criteria state: “Any condition that will permit intrusion of moisture against the inaccessible areas of the pressure retaining surfaces of the

metallic liner SHALL be repaired or replaced." Inspection of the moisture barrier will be continued within the IWE program during the period of extended operation.

The project team reviewed and determined that the applicant's response concerning plant-specific operating experience, corrective actions, and augmented inspections confirms the applicant's commitment to take necessary preventive measures, in order to minimize loss of material due to corrosion in inaccessible areas of the steel liner.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.4 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature (BSEP LRA Section 3.5.2.2.1.5)

In Section 3.5.2.2.1.5 of the BSEP LRA, the applicant states that the BSEP primary containment structure is constructed of reinforced concrete. There are no prestressed tendons associated with the primary containment structure design. Therefore, the aging effect, loss of prestress, is not applicable to the BSEP primary containment structure.

3.5.2.1.6 Cumulative Fatigue Damage (BSEP LRA Section 3.5.2.2.1.6)

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the BSEP LRA.

3.5.2.1.7 Cracking Due to Cyclic Loading and SCC (BSEP LRA Section 3.5.2.2.1.7)

The project team reviewed BSEP LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7, which states:

> Cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading or SCC could occur in all types of PWR and BWR containments. Cracking could also occur in vent line bellows, vent headers and downcomers due to SCC for BWR containments. A visual VT-3 examination would not detect such cracks. The GALL Report recommends further evaluation of the inspection methods implemented to detect these aging effects.

In BSEP LRA Section 3.5.2.2.1.7, the applicant states that The GALL Report discussion involves cracking due to cyclic loading and SCC of carbon steel, stainless steel, and dissimilar metal welds in containment penetration sleeves and bellows, and in vent line bellows, vent headers, and downcomers. BSEP penetrations do not use expansion bellows, and penetration sleeves are fabricated from carbon steel. However, some penetrations incorporate stainless steel components, which require dissimilar metal welds. The vent line bellows are fabricated from stainless steel, and the vent header and downcomers are fabricated from carbon steel.

The applicant further states that SCC is not an applicable aging effect for these components, because (1) carbon steel components are not susceptible to SCC, and (2) to be susceptible to SCC, stainless steel must be subject to both high temperature (>140°F) and an aggressive chemical environment. Components fabricated from stainless steel are not subject to an aggressive chemical environment.

The applicant further states that cracking of metal components owing to cyclic loads is a potential aging effect. However, the AMR, as supported by operating experience, concluded that cyclic loading from plant heatups and cooldowns, containment testing, and from system vibration was very low or limited in numbers of cycles; therefore, additional methods of detecting postulated cracking were not warranted. The applicant also noted that the cyclic loading of the vent header and downcomers has been analyzed as a TLAA, and addressed in BSEP LRA Subsection 3.5.2.2.1.6.

The applicant further states that, for the steel elements of containment that are part of the IWE pressure boundary; both the ASME Section XI, Subsection IWE and the 10 CFR Part 50, Appendix J programs are used to monitor for degradation. However, the vent line bellows are inaccessible, and only the accessible surface areas of the assembly are subject to visual examination. A review of BSEP operating experience indicates that cracking has not been a concern for steel containment pressure boundary components.

The applicant concludes that, based on the above discussion, potential cracking of steel containment components is not expected, and use of the combination of the ASME Section XI, Subsection IWE Program and the 10 CFR Part 50, Appendix J program, as recommended by The GALL Report, will adequately assure the detection of cracking should it occur.

The project team concurs with the applicant's further evaluation, with one exception. The project team noted that specific Mark I bellows design(s) have experienced cracking, and that the cracking was not detected by Appendix J leak rate testing. The project team requested the applicant to describe the BSEP bellows design, compared to the design(s) that developed cracks that were undetectable by Appendix J leak rate testing; and provide the technical basis for the determination that Appendix J leak rate testing would be able to detect cracks in the inaccessible regions of the BSEP vent line bellows.

The applicant stated that the bellows degradation referenced for another plant in their SER (NUREG-1796) was identified while conducting Appendix J testing and was associated with a 2-ply bellows. The subject bellows were replaced with a single-ply bellows. The Brunswick Containment Inspection Program (0BNP-TR-002) addresses the vent line bellows within Appendix F, Augmented Areas, as follows:

> Occurrences with transgranular stress corrosion cracking (TGSCC) with two-ply containment bellows were also identified. The containment design at BNP employs a single-ply containment bellows. These containment bellows are located inside the Suppression Chamber and are insulated by a protective cover. Unlike the examples given in SECY-96-080, a failure caused by transgranular stress corrosion cracking of these bellows is minimal. The controlled atmosphere, the protective cover over the bellows, and the location of these bellows inside the Suppression Chamber does not provide the environment (e.g., high temperature, surfaces exposed to a chemical environment, etc.) which is

known to initiate stress corrosion cracking. In addition, no leakage associated with these bellows has been identified during previous Type A tests. Thus, this type of degradation at BNP is not a concern.

The project team acknowledges that the applicant is correct in that the other plant's bellows cracking was detected by Appendix J testing. BSEP employs a single-ply containment bellows design, the environment is not conducive to SCC, and previous BSEP Appendix J, Type A tests have not identified any leakage associated with the bellows. On this basis, the project team concluded that Appendix J, Type A leak rate testing is sufficient to manage cracking in the inaccessible regions of the BSEP vent line bellows, and determined that the applicant's further evaluation is acceptable.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.7 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 Class 1 Structures (BSEP LRA Section 3.5.2.2.2)

3.5.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program (BSEP LRA Section 3.5.2.2.2.1)

The project team reviewed BSEP LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1, which states:

> The GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) scaling, cracking, and spalling due to repeated freeze-thaw for Groups 1-3, 5, 7-9 structures; (2) scaling, cracking, spalling and increase in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack for Groups 1-5, 7-9 structures; (3) expansion and cracking due to reaction with aggregates for Groups 1-5, 7-9 structures; (4) cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for Groups 1-5, 7-9 structures; (5) cracks, distortion, and increase in component stress level due to settlement for Groups 1-3, 5, 7-9 structures; (6) reduction of foundation strength due to erosion of porous concrete subfoundation for Groups 1-3, 5-9 structures; (7) loss of material due to corrosion of structural steel components for Groups 1-5, 7-8 structures; (8) loss of strength and modulus of concrete structures due to elevated temperatures for Groups 1-5; and (9) crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liner for Groups 7 and 8 structures. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program. Technical details of the aging management issue are presented in SRP-LR Subsection 3.5.2.2.1.2 for items (5) and (6) and Subsection 3.5.2.2.1.3 for item (8).

In BSEP LRA Section 3.5.2.2.2.1, the applicant states that aging effects associated with freeze/thaw; leaching of calcium hydroxide; reaction with aggregates; corrosion of embedded steel; and aggressive chemical attack of concrete are not applicable, as discussed in the plant-specific noted associated with Tables 3.5.2-1 through 3.5.2-15. Nevertheless, the structures monitoring program is credited for aging management of these effects/ mechanisms for the affected structures, in accordance with the current NRC position (ISG-03). Corrosion of structural steel components is addressed by the structures monitoring program.

The applicant further states that aging effects associated with The GALL Report, Volume 2, item III.A4.2-b, involve Lubrite slide bearing plates. The plates provide a low friction barrier between the equipment and their support structures. Based on a review of industry operating experience, and after 20 years of service at BSEP, there has been no adverse experience data recorded for the Lubrite sliding surfaces for applications both inside and outside containment. Based on the low cycle service required, it is concluded the Lubrite bearing plates will continue to perform their intended function for the period of extended operation.

The project team requested the applicant to describe any inspections of Lubrite plates that are currently conducted under IWF, Maintenance Rule, or any other existing program; whether these inspections will continue during the extended period of operation; and whether they are credited for LR aging management.

In its response, the applicant stated that, as addressed by previous applicants and concurred by the NRC staff, Lubrite resists deformation, has a low coefficient of friction, resists softening at elevated temperatures, absorbs grit and abrasive particles, is not susceptible to corrosion, tolerates high intensities of radiation, and will not score or mar. In addition, Lubrite products are solid, permanent, completely self-lubricating, and require no maintenance, as documented in NUREG-1759, Safety Evaluation Report Related to the License Renewal of Turkey Point Nuclear Plant, Units 3 and 4. A search of industry operating experience found no reported instances of lubrite plate degradation or failure to perform their intended function, and after more than 20 years of service there has been no adverse experience data recorded for Brunswick Lubrite plates. It is therefore concluded that Brunswick Lubrite plates will not require aging management to perform their intended functions for the period of extended operation.

The applicant further stated that there is no inspection criteria specific to Lubrite in either the IWF or Maintenance Rule inspection programs. The IWF and Maintenance Rule programs monitor components within their scope for corrosion, deformation, cracks, damaged members, etc.; as such, any visual degradation of the component, associated with Lubrite, would be identified and evaluated. The IWF program is credited for License Renewal and will be continued during the period of extended operation. Maintenance Rule inspections will be continued during the period of extended operation. The structures monitoring program, which utilizes the same inspection procedure credited by Maintenance Rule, is credited for License Renewal aging management during the period of extended operation for non-IWF supports.

The project team reviewed and determined the applicant's further evaluation for Lubrite plates to be acceptable, on the basis that there is no industry or plant-specific history of degradation, and on the basis that the AMPs credited by BSEP for inspection of component supports would identify and evaluate any visual degradation of Lubrite, should it occur.

The project team finds that, based on the programs identified above, the applicant has met the

criteria of SRP-LR Section [3.5.2.2.2.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2 Aging Management of Inaccessible Areas (BSEP LRA Section 3.5.2.2.2.2)

The project team reviewed BSEP LRA Section 3.5.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2, which states:

> Cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack, and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas. The GALL Report recommends further evaluation to manage these aging effects in inaccessible areas of Groups 1-3, 5, 7-9 structures, if specific criteria defined in the GALL Report cannot be satisfied.

In BSEP LRA Section 3.5.2.2.2.2, the applicant states that the service water intake structure is the only structure with concrete elements subject to aggressive ground water. The structure is located adjacent to the intake canal; therefore, the environmental parameters of the intake water have been applied to the below grade portions of the concrete. Groundwater monitoring is performed periodically to validate that the below-grade environment is not aggressive for in-scope structures other than the service water intake structure. Examination of representative samples of below-grade concrete, when excavated for any reason, will be included as part of the structures monitoring program, which will be used to manage aging due to aggressive chemical attack and corrosion of embedded steel.

In its review of the BSEP structures monitoring program, as documented in Section 2.22 of this audit report, the project team confirmed that the BSEP structures monitoring program includes periodic inspection of the submerged portions of the service water intake structure; periodic groundwater monitoring to validate that the below-grade environment is not aggressive; and examination of representative samples of below-grade concrete, when excavated for any reason. For below-grade, inaccessible concrete areas, the applicant meets the specific criteria recommended in the GALL Report. For the service water intake structure, the applicant has defined an aging management program that is consistent with the recommendations of GALL AMP XI.S7, “Inspection of Water Control Structures”, and included it as part of the BSEP structures monitoring program.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3 Component Supports (BSEP LRA Section 3.5.2.2.3)

3.5.2.3.1 Aging of Supports Not Covered by Structures Monitoring Program (BSEP LRA Section 3.5.2.2.3.1)

The project team reviewed BSEP LRA Section 3.5.2.2.3.1 against the criteria in SRP-LR Section 3.5.2.2.3.1, which states:

> The GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; (2) loss of material due to environmental corrosion, for Groups B2-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

In BSEP LRA Section 3.5.2.2.3.1, the applicant states that The GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. Degradation of these components/commodities at BSEP is managed by the structures monitoring program.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.3 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Cumulative Fatigue Damage Due to Cyclic Loading (BSEP LRA Section 3.5.2.2.3.2)

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the BSEP LRA. Therefore, the project team did not review this item.

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the GALL Report recommends further evaluation, the project team determines that the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Aging Management Review Results That Are Not Consistent With the GALL Report or Are Not Addressed in the GALL Report

AMRs that are plant specific and are not consistent with the GALL Report, as identified in BSEP LRA Table 2s with generic Notes F through J, were reviewed by NRR DE staff and will be addressed in Section 3 of the SER related to the BSEP LRA.

## 3.6 BSEP LRA Section 3.6 - Aging Management of Electrical and Instrumentation and Controls

In the BSEP LRA Section 3.6, the applicant provided the results of its AMRs for the electrical and instrumentation and controls.

In BSEP LRA Table 3.6.2-1, in the BSEP LRA the applicant provided a summary of the AMR results for components/commodities associated (1) Non-EQ Insulated Cables and Connections; (2) Medium-Voltage Power Cables; (3) Non-EQ Cables Used in Radiation Monitoring Instrumentation or Neutron Flux Instrumentation Circuits; (4) Phase Bus; (5) Non-EQ Electrical and I&C Penetration Assemblies and Penetration Assembly Pigtails; (6) High-Voltage Insulators; (7) Switchyard Bus; and (8) Transmission Conductors.

The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the BSEP LRA Table 3.6.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in the BSEP LRA Table 3.6.1 those components that are consistent with the GALL Report where no further evaluation is required, those that are consistent with the GALL Report in which further evaluation is recommended, and those that are not addressed in the GALL Report together with the basis for their exclusion.

The project team conducted its audit and review in accordance with SRP-LR Section 3.6.3 and the BSEP audit plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

### 3.6.1 Aging Management Review Results That Are Consistent With the GALL Report

For AMRs that the applicant states are consistent with the GALL Report, the project team conducted its audit to determine if the applicant's reference to the GALL Report in the BSEP LRA are acceptable.

The project team reviewed its assigned BSEP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the Non-EQ Insulated Cables and Connections, Medium-Voltage Power Cables, Non-EQ Cables Used in Radiation Monitoring Instrumentation or Neutron Flux Instrumentation Circuits, Phase Bus, Non-EQ Electrical and I&C Penetration Assemblies and Penetration Assembly Pigtails, High-Voltage Insulators, Switchyard Bus, and Transmission Conductor components that are subject to an AMR.

#### 3.6.1.1 Embrittlement, Cracking, Melting, Discoloration, Swelling, or Loss of Dielectric Strength Leading to Reduced Insulation Resistance (IR); Electrical Failure for non-EQ Insulated Cables and Connections

In the discussion section of Table 3.6.2-1 the applicant includes an AMR line item for non-EQ insulated cables and connections with insulation constructed of various organic polymers and exposed to adverse localized environments, including heat, radiation, or moisture in the

presence of oxygen. The electrical cables and connections not subject to 10 CFR 50.49 EQ program (BSEP AMP B.2.25) is specified to manage various aging effects. GALL Report line item VI.A.1-a is referenced, which also identifies radiolysis and photolysis, for UV sensitive materials, as aging effects to be managed for this material/environment combination. The applicant's AMR does not address these aging effects. During the audit and review the project team asked the applicant to clarify the reason for this omission.

In its letter dated March 14, 2005 (ML050810493) the applicant stated the BSEP LRA Table 3.6.2-1 will be revised to include these aging effects for this commodity group.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.6.1.2 Non-EQ Electrical and I&C Penetration Assemblies

In the discussion section of Table 3.6.2-1 the applicant includes an AMR line item for non-EQ electrical and I&C penetration assemblies that are constructed of various materials and exposed to adverse localized environments caused by heat or radiation in the presence of oxygen. No aging effects or aging management program are noted, and there is no generic note indicating if this AMR is consistent with the GALL Report. During the audit and review the project team asked the applicant to identify the generic note for this AMR line item.

In its letter dated March 14, 2005 (ML050810493) the applicant stated that generic Note J applies to this AMR line item. BSEP LRA Table 3.6.2-1 will be revised to reflect this.

On the basis that generic Note J applies, which indicates that this AMR is not consistent with the GALL Report, this AMR was not in the audit scope and was not reviewed by the project team.

On the basis of its audit and review, the project team reviewed and determined that for AMRs not requiring further evaluation, as identified in the BSEP LRA Table 3.6.1 (Table 1), the applicant's references to the GALL Report are acceptable and 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2 Aging Management Review Results For Which Further Evaluation Is Recommended By the GALL Report

For some line-items assigned to the project team in the BSEP LRA Table 3.6.2-1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in BSEP LRA Section 3.6.2.2 against the criteria provided in the SRP-LR Section 3.6.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.6 citing the item in Table 1.

3.6.2.1 Electrical Equipment Subject to Environmental Qualification (BSEP LRA Section 3.6.2.2.1)

Environmental Qualification is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be

evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TALL is performed by NRR DE staff and addressed in Section 4 of the SER related to the BSEP LRA.

3.6.3 Aging Management Review Results That Are Not Consistent With the GALL Report or Are Not Addressed in the GALL Report

AMRs that are plant specific and are not consistent with the GALL Report, as identified in BSEP LRA Table 2s with generic Notes F through J, were reviewed by NRR DE staff and will be addressed in Section 3 of the SER related to the BSEP LRA.

## 4. TIME-LIMITED AGING ANALYSES (TLAA)

### 4.1 Service Level I Coatings Qualifications

Two areas of technical review are required to support an application for a renewed operation license. The first area of technical review is the Integrated Plant Assessment, described in Chapters 2 and 3 of the BSEP LRA. The second area of technical review is the identification and evaluation of plant-specific time-limited aging analyses (TLAAs). The TLAA evaluation included in this section of the audit report meets the requirements contained in 10 CFR 54.21(c) and allows the NRC to make the finding contained in 10 CFR 54.29(a)(2).

#### 4.1.1 Summary of Technical Information in the Application

In BSEP LRA Section 4.7, the applicant describes the analysis of radiation degradation of Service Level 1 coatings that are used inside the primary containment of BSEP Units 1 and 2. The applicant considers the coating to be safety-related because they could potentially detach during a design basis accident and the coating debris could contribute to flow blockage of emergency core cooling system suction strainers. The qualification of the coatings to withstand the effects of radiation and the DBA conditions assures these coatings will remain in place and not contribute to clogging the ECCS strainers beyond analyzed limits.

The original BSEP qualification tests were performed for the coating prior to original plant startup using radiation values necessary to bound 40 years of service and using DBA parameters based upon original licensed thermal power limits. Additional qualifications were performed later to support the use of different brands of coating used for coating repairs and refurbishment from 1994 to the present.

The coatings used for Service Level 1 applications at BSEP were qualified and applied in accordance with the requirements of the following documents:

- USNRC Regulatory Guide 1.54, “Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants,” issued June 1973
- ANSI N101.4 – 1972, “Quality Assurance for Protective Coatings Applied to Nuclear Facilities”
- ANSI N101.2 – 1972, Protective Coatings (Paints) for Light Water Nuclear Containment Facilities”

- ANSI N512 – 1974, “Protective Coatings (Paints) for the Nuclear Industry”

Since it is assumed that the degree of radiation exposure used in the qualification testing was intended to bound 40 years of operation, this evaluation will determine whether or not the radiation exposure used in the qualification tests bounds the projected exposure for 60 years of operation.

The applicant prepared an analysis that provides the design basis radiation projections for Environmental Qualification (EQ) of electrical components. The applicant adjusted the current revision of this EQ analysis to account for previously approved power uprate conditions and the 60-year period of extended operation. The analysis results for the total integrated exposure for 60 years of operation plus the design basis accident dose is $3.4 \times 10^8$ Rads. This is the worst-case bounding value for primary containment, using the value projected for the torus. If a test coupon has been exposed to this level of radiation or greater, followed by acceptable DBA testing, it will be considered qualified for the 60-year period of operation.

The applicant also reviewed the test reports used to qualify the specific coating types used inside primary containment and determined the total radiation exposure applied during qualification testing is at least $1.0 \times 10^9$ Rads. The applicant compared the qualified dose values to the worst-case values bounding 60-year of service plus accident radiation exposure calculated above. On the basis of this comparison, the applicant determined that radiation exposure levels remain valid for the period of extended operation. The applicant concluded that the analyses of qualification of Service Level 1 coatings have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.1.2 Staff Evaluation

In accordance with 10 CFR 54.21(c)(1), for each CLB analysis that is identified as a TLAA the applicant must demonstrate that (i) the analysis remains valid for the period of operation, (ii) the analysis has been projected to the end of the period of extended operations, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operations.

The project team reviewed portions of Nuclear Generation Group, BNP-LR-504, “Service Level 1 Coatings Time-Limited Aging Analysis (TLLA) Evaluation for License Renewal,” Rev 0 (Draft). The calculation include projected radiation exposure values updated to account for the effects of the 5% power uprate, the 20% power uprate, and 60-year period of extended operation. The analysis that provides the design basis radiation projections for Environmental Qualification (EQ) of electrical components is described in BSEP LRA Section 4.4.2, “EQ Component Reanalysis Attributes.” The NRC staff (NRR/DE) will evaluate the radiation analysis in SER Section 4.4, “Environmental Certification of Electrical Equipment.”

The calculation also evaluated the radiation exposures used in the acceptance tests for the different types of qualified coatings. In BNP-LR-504, the applicant identifies the specific coating types used inside the primary containments of BSEP Units 1 and 2, the general locations where the coatings were used, the time frames in which the coatings were applied, and the applicable qualification test reports that contain the radiation levels and temperatures for each test.

The applicant applied Keeler and Long 6548 / 7107 epoxy primer and topcoat to all carbon steel surfaces inside containment during original construction. The Keeler and Long qualification coupons were exposed to 1.0 X $10^9$ Rads.

The applicant applied Ameron Amercoat 90 epoxy coating as the replacement coating in the immersion zone of each torus during the coating refurbishment performed in 1994 - 1996. The applicant removed the original Keeler and Long coatings in the immersion zone of each torus and applied two coats of Amercoat. The Amercoat qualification coupons were exposed to 1.0 X $10^9$ Rads.

The applicant used Carboline 801 epoxy coatings in the vapor zone (above the water) of the Unit 2 torus for repairs and overlaps between the Keller and Long coatings and the Ameron Amercoat coating. The Carboline epoxy coating over bare steel qualification coupons were exposed to 1.0 X $10^9$ Rads . However, the Carboline 801 coating over the Keeler and Long Coatings qualification coupons were exposures to 2.0 X $10^8$ Rads. On the basis of its review of the specific tests the applicant determined that the combination qualification was equivalent to an exposure to 3.0 X $10^8$ Rads. In addition the Design Basis Accident (DBA) tests demonstrated that the Carboline coating remained satisfactorily bonded to the Keeler and Long substrate coatings when exposed to the rapid temperature and pressure changes associated with the DBA. Therefore, the applicant considered the coatings where the Carboline overlapped the Keeler and Long coatings were qualified for 60 years.

The applicant used Carboline 890 epoxy coating in the vapor zone of the torus and in the dry well of each unit. The Carboline 890 qualification test coupons originally credited for BSEP applications were exposed to 3.0 X $10^8$ Rads. However, these test reports are no longer being credited because they did not fully envelop the extended power uprate DBA conditions. The applicant used Susquehanna test reports to replace the original qualifications reports. The test coupons evaluated in the Susquehanna test report for Caroline 890 epoxy over bare steel, for Carboline 890 over Keeler and Long epoxy primer and topcoat, and for Carboline 890 over Ameron Amercoat 90 were exposed to 1.0 X $10^9$ Rads.

The applicant evaluated each of the qualification test reports, which it used to support the use of Service Level 1 coatings types, with respect to radiation exposure levels for 60 years of service and determined that the coatings are qualified for the period of extended operations.

The project team reviewed and determined that the applicant painted the containments and the emersion zone of each torus with coatings qualified to 1.0 X $10^9$ Rads. For coatings used for overlapping the two types of coating and for repairs, the applicant performed additional evaluations to determine that the coatings were qualified to greater than 1.0 X $10^9$ Rads. The project team reviewed and determined that the applicant updated these qualified coating test reports using methodologies in accordance with NRC requirements and accepted industry practices. Therefore, the project teams determined that an exposure of 1.0 X $10^9$ Rads is a reasonable value for the qualified coatings in the containments.

The project team reviewed and determined that the radiation exposures used to qualify the coatings (at least 1.0 X $10^9$ Rads) are greater than the projected radiation exposures over the period of extended operations (3.4 X $10^8$ Rads). Therefore, the project team reviewed and determined that the applicant's analysis is acceptable because the analysis has been projected through the end of the period of extended operation.

4.1.3 Conclusion

On the basis if its review, the staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the radiation degradations of Service Level 1 coatings inside the containment has been projected to the end of the period of extended operations. The staff also concludes that the USFAR Supplement contains an appropriate summary description of the TLAA evaluation of radiation degradation on the Service Level 1 coatings inside the containment for the period of extended operation, as required by 10 CFR 54.21(d). Therefore, the staff has reasonable assurance that the safety margins established and maintained during the current operating term will be maintained during the period of extended operation, as required by 10 CFR 54.21(c)(1).

## ATTACHMENT 1: Abbreviations and Acronyms

| | |
|---|---|
| ACI | American Concrete Institute |
| ADAMS | Agencywide Documents Access and Management System |
| AMP | aging management program |
| AMR | aging management review |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing Materials |
| | |
| BNL | Brookhaven National Laboratory |
| BSEP | Brunswick Steam Electric Plant |
| BTP | Branch Technical position |
| BWR | boiling water reactor |
| BWRVIP | Boiling Water Reactor Vessel Improvement Program |
| | |
| C | Celsius |
| CASS | cast austenitic stainless steel |
| CFR | Code of Federal Regulations |
| CLB | current licensing basis |
| | |
| DE | Division of Engineering |
| DIPM | Division of Inspection Program Management |
| DSSA | Division of Systems Safety and Analysis |
| | |
| EDG | emergency diesel generator |
| EPRI | Electric Power Research Institute |
| ESF | engineered safety features |
| EQ | environmental qualification |
| | |
| F | Fahrenheit |
| FAC | flow-accelerated corrosion |
| FSAR | Final Safety Analysis Report |
| | |
| GALL | Generic Aging Lessons Learned |
| GL | Generic Letter |
| GSI | Generic Safety Issue |
| | |
| I&C | instrumentation and control |
| IASCC | irradiation assisted stress corrosion cracking |
| IGSCC | intergranular stress corrosion cracking |
| IN | Information Notice |
| INPO | Institute of Nuclear Power Operations |
| ISG | Interim Staff Guidance |
| ISI | inservice inspection |
| | |
| LER | licensee event report |
| BSEP LRA | license renewal application |

| | |
|---|---|
| MIC | microbiologically influenced corrosion |
| $n/cm^2$ | neutrons per square centimeter |
| NDE | nondestructive examination |
| NEI | Nuclear Energy Institute |
| NPS | nominal pipe size |
| NRC | U.S. Nuclear Regulatory Commission |
| NRR | Office of Nuclear Reactor Regulation |
| NUMARC | Nuclear Management and Resources Council |
| NUREG | Nuclear Regulatory Commission technical report |
| ppb | parts per billion |
| ppm | parts per million |
| PWR | pressurized water reactor |
| RAI | request for additional information |
| RCPB | reactor coolant pressure boundary |
| RCS | reactor coolant system |
| RG | Regulatory Guide |
| RLEP-B | License Renewal and Environmental Impacts Program, Section B |
| RLSB | License Renewal and Standardization Branch |
| SBO | station blackout |
| SCC | stress corrosion cracking |
| SC | structures and components |
| SER | Safety Evaluation Report |
| SLC | standby liquid control |
| SRP-LR | Standard Review Plan-License Renewal |
| SSC | structure, system, and component |
| SW | service water |
| TLAA | time-limited aging analysis |
| UFSAR | Updated Final Safety Analysis Report |

## ATTACHMENT 2: PROJECT TEAM AND APPLICANT PERSONNEL; PUBLIC EXIT MEETING ATTENDEES

### Project Team

G. Cranston, NRC, Team Leader
N. Dudley, NRC, Backup Team Leader
T. Terry, NRC, Reviewer - Structural
D. Nguyen, NRC, Reviewer - Electrical
L. Tran, NRC, Reviewer - Electrical
R. Morante, BNL, Lead Reviewer – Mechanical, Materials, Structural
M. Subudhi, BNL, Reviewer – Materials, Mechanical
R. Lofaro, BNL, Reviewer – AMRs, Systems, Mechanical
K. Sullivan, BNL, Reviewer – AMPs, Systems, Fire Protection
E. Grove, BNL, Reviewer - AMPs, Systems, Mechanical
B. Anderson, Quality Staffing, Administative Support

### Project Team Support

S. West, NRC, Chief, RLEP Section B
K. Chang, Acting Chief, NRC RLEP Section B
S.K. Mitra, NRC, BSEP LR Project Manager

### Applicant PersonnelAudit Participants

W. Bichlmeir
T. Clements
K. Core
M. Fletcher
M. Gutherie
M. Heath
K. Karcher
J. Lane
C. Mallner
T. Overton
T. Ploplis
E. Williams

### Attendees at Public Exit Meeting on March 3, 2005

T. Clements, Progress Energy
M. Heath, Progress Energy
E. O'Neil, Progress Energy
T. Cleary, Progress Energy
M. McCracken, Progress Energy
S. Tabor, Progress Energy
K. Karcher, Progress Energy
S. Dort, First Energy
L. Garrett,First Energy
G. Cranston, NRC
S.K. Mitra, NRC
F. Talbot, NRC
K. Kavanagh, NRC
J. Golla, NRC
P. Kim Van Doorn, NRC
G. DiPaolo, NRC
B. Rogers, NRC
R. Pettis, NRC

NOTE: There were no members of the public at the Public Exit Meeting.

**ATTACHMENT 3: Elements of an Aging Management Program for License Renewal**

| Element | Description |
|---|---|
| 1. Scope of the program | The scope of the program should include the specific structures and components subject to an aging management review. |
| 2. Preventive actions | Preventive actions should mitigate or prevent the applicable aging effects. |
| 3. Parameters monitored or inspected | Parameters monitored or inspected should be linked to the effects of aging on the intended functions of the particular structure and component. |
| 4. Detection of aging effects | 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. |
| 5. Monitoring and trending | Monitoring and trending should provide prediction of the extent of the effects of aging and timely corrective or mitigative actions. |
| 6. Acceptance criteria | Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the particular structure and component intended functions are maintained under all current licensing basis design conditions during the period of extended operation. |
| 7. Corrective actions (Audited by DIPM)* | Corrective actions, including root cause determination and prevention of recurrence, should be timely. |
| 8. Confirmation process (Audited by DIPM)* | The confirmation process should ensure that preventive actions are adequate and appropriate corrective actions have been completed and are effective. |
| 9. Administrative controls (Audited by DIPM)* | Administrative controls should provide a formal review and approval process. |
| 10. Operating experience | Operating experience involving the aging management program, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support a determination that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation. |

* DIPM = Division of Inspection Program Management

**ATTACHMENT 4: Disposition of Requests for Additional Information, BSEP LRA Supplements, and Open Items**

Items that could not be closed out at the time this audit report was issued are documented in the following table.

| Audit Report Section | Follow-Up Item | Description |
|---|---|---|
| 3.1.1.1 | N/A | EVT-1 is not consistent with the discussion in the AMR line for core shroud/core plate AHC, which states the examination should be a UT examination method. This issue will be dispositioned by DE in the BSEP LRA SER in conjunction with their review of BSEP AMP B.2.28 and is being tracked as RAI B.2.28-6, Parts A and B. |

## ATTACHMENT 5: LIST OF DOCUMENTS REVIEWED

The following is a list of applicant documents reviewed by the project team, including documents prepared by others for the applicant. Inclusion of a document in this list does not imply that the project team reviewed the entire document, but rather that selected sections or portions of the document were reviewed during the on-site audits. In addition, inclusion of a document in this list does not imply NRC acceptance of the document.

| BSEP Aging Management Program | Corresponding GALL Aging Management Program | BSEP AMP Basis Document and Other Documents Reviewed, in addition to BSEP LRA |
|---|---|---|
| ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program, (BSEP AMP B.2.1) | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (GALL AMP XI.M1) | BNP-LR-606, “License Renewal Aging Management Program Description of the ASME, Section XI, Subsections IWB, IWC, and IWD, Inservice Inspection (ISI) Program,” Rev. 1<br><br>OENP-16, ”Procedure for Administrative Control of Inservice Inspection Activities,” Rev. 43<br><br>OENP-16.2, “Administrative Control of ASME Section XI Non-Destructive Examination Program,” Rev. 16<br><br>OPLP-08, ”Repair/Replacement Program,” Rev. 22<br><br>OENP-16.9, “Administrative Control of The ASME Section XI Pressure Testing Program,” Rev. 13<br><br>BNP-LR-011, “Operating Experience (OE) Review of Materials and Programs For License Renewal,” Rev.0<br><br>OPT-90-1, “Vessel Internal Component Remote Inspection,” Rev. 28<br><br>OBNP-TR-001, “Inservice Inspection Technical Report,” Rev. 5<br><br>OENP-15, “Reactor Vessel & Internals Structural Integrity Program,” Rev. 0 |

| | | |
|---|---|---|
| | | B-ES-03-01, “Progress Energy Brunswick Nuclear Power Plant Nuclear Assessment Section Report,” May 13, 2003<br><br>Other:<br><br>NRC Letter to Mr. C.J. Gannon from Victor M. McCree "Brunswick Steam Electric Plant-NRC Integrated Inspection Report Nos. 05000325/2004002 and 05000324/2004002; Preliminary White Finding,” April 19, 2004 |
| Water Chemistry Program (BSEP AMP B.2.2) | Water Chemistry (GALL AMP XI.M2) | BSEP:<br><br>BNP-LR-600, “License Renewal Aging Management Program Description of the Water Chemistry Program,” Rev. 1<br><br>BNP-LR-306, “LR AMR Reactor Vessel and Internals System,” Rev. 2<br><br>0AI-81, “Water Chemistry Guidelines,” Rev. 37<br><br>0E&RC-1000, “Sampling and Analysis for Technical, ODCM, and TRM Specifications Chemistry,” Rev. 49<br><br>0E&RC-1001, “Sampling and Analysis for Non-Regulatory Specifications Chemistry,” Rev. 33<br><br>B-ERC-02-01(BNAS 02-036), “Environmental and Radiation Control Assessment,” June 5, 2002<br><br>Other:<br><br>NUREG-1544, “Status Report: Intergranular SCC of BWR Core Shroud and Other Internal Components,” March 1996 |
| Reactor Head Closure Studs Program (BSEP AMP B.2.3) | Reactor Head Closure Studs (GALL AMP XI.M3) | BSEP:<br><br>BNP-LR-619, “License Renewal Aging Management Program Description of the |

| | | |
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| | | Reactor Head Closure Studs Program," Rev. 0<br><br>Other:<br><br>NRC Regulatory Guide 1.65, "Materials and Inspections for Reactor Vessel Closure Studs," October 1973<br><br>NEDC-31735P, "BWR Operator's Manual for Materials and Processes," (pg. 2.01-55), September 1990 |
| BWR Stress Corrosion Cracking Program (BSEP AMP B.2.4) | BWR Stress Corrosion Cracking (GALL AMP XI.M7) | BSEP:<br><br>BNP-LR-654, "License Renewal Aging Management Program Description of the BWR Stress Corrosion Cracking Program," Rev. 1<br><br>0ENP-16.2, "Administrative Control of ASME Section XI Non-destructive Examination Program," Rev. 16<br><br>CPL-53Q-301, "Risk Informed ISI Code Case N-578: Application to BSEP Units 1 and 2: Degradation Mechanisms Evaluation of Brunswick Units 1 and 2," Rev. 2<br><br>BSEP 94-0335, NRC GL 94-03 Response, 8-24-1994<br><br>BSEP 95-0080, NRC GL 94-03 Response, 2-10-1995<br><br>BSEP 96-0149, NRC GL 94-03 Response, 4-29-1996<br><br>BSEP 96-0432, NRC GL 94-03 Response, 12-3-1996 |
| Flow-Accelerated Corrosion Program (BSEP AMP B.2.5) | Flow-Accelerated Corrosion (GALL AMP XI.M17) | BSEP:<br><br>BNP-LR-603, "License Renewal Aging Management Program Description of the Flow-Accelerated Corrosion (FAC) Program," |

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| | | Revision 1<br><br>EGR-NGGC-0202, “Flow Accelerated Corrosion Monitoring Program,” Revision 8<br><br>AR 100627-45 Action Plan, “FAC Program Implementation Plan,” issued January 11, 2005<br><br>Calculation Number 0132-00142-01, “Brunswick Units 1 & 2 Systems Elimination Calculation,” Revision 0, December 16,1993<br><br>Other:<br><br>EPRI Report NSAC-202L-R2, "Recommendations for an Effective Flow-Acceleration Corrosion Program," April 1999 |
| Bolting Integrity Program<br>(BSEP AMP B.2.6) | Bolting Integrity (GALL AMP XI.M18) | BSEP:<br><br>BNP-LR-625, “License Renewal Aging Management Program Description of the Bolting Integrity Program,” Rev. 1<br><br>OMMM-017, “Maintenance Methods and Guidelines for Torquing,” Rev. 23<br><br>CHE-NGGC-0045, “NGG Chemical Control Program,” Rev. 9<br><br>BNP-LR-608, “License Renewal Aging Management Program Description of the Structures Monitoring Program,” Rev. 1<br><br>BNP-LR-640, “License Renewal Aging Management Program Description Of The Systems Monitoring Program,” Rev. 0<br><br>BNP-LR-606, “License Renewal Aging Management Program Description of the ASME, Section XI, Subsections IWB, IWC, and IWD, Inservice Inspection (ISI) Program,” Rev. 1<br><br>Other: |

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| Open-Cycle Cooling Water System Program (BSEP AMP B.2.7) | Open-Cycle Cooling Water System (GALL AMP XI.M20) | BSEP:<br><br>BNP-LR-602, “License Renewal Aging Management Program Description of the Open Cycle Cooling Water System Program,” Rev. 1<br><br>CAP-NGGC-0202, “Operating Experience Program,” Rev. 8<br><br>0ENP-2704, “Administrative Control of NRC Generic Letter 89-13 Requirements,” Rev. 8<br><br>DBD-43, “Service Water System,” Rev. 4<br><br>AR 106070, “Enhancement of Programmatic Controls Associated with the Open Cycle Cooling Water Program”<br><br>NLS-90-005, CP&L Response To NRC Generic Letter 89-13<br><br>BNP-LR-642, “License Renewal Aging Management Program Description Of The Preventive Maintenance Program,” Rev. 0<br><br>CAP-NGGC-0200, “Corrective Action Program,” Rev. 14<br><br>AR 106130, “Resolution of an Inpo/wano Concern with Testing of Service Water Cooled Heat Exchangers”<br><br>EGR-NGGC-0008, “Engineering Programs,” Rev. 5<br><br>EGR-NGGC-0504, “Mechanical System Aging Management Review for License |

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| Closed-Cycle Cooling Water System Program (BSEP AMP B.2.8) | Closed-Cycle Cooling Water System (GALL AMP XI.M21) | BSEP:<br><br>BNP-LR-627, " License Renewal Aging Management Program Description Of The Closed Cycle Cooling Water Program," Rev. 1<br><br>0E&RC-1001, "Plant Operating Manual Volume VIII Environmental & Radiation Control Procedure, Sampling and Analysis for Non-Regulatory Specification Chemistry," Rev. 33<br><br>0AI-81, "Plant Operating Manual Volume I, Book 2, Administrative Instruction Water Chemistry Guidelines," Rev. 37<br><br>BNP-LR-640, "License Renewal Aging Management Program Description Of The Systems Monitoring Program," Rev. 0<br><br>AR 53006, "BSEP Self-Assessment Report Closed Cooling Water Chemistry Program"<br><br>CAP-NGGC-0202, "Operating Experience Program," Rev. 8<br><br>CAP-NGGC-0200, "Corrective Action Program," Rev. 14 |

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| Inspection of Overhead Heavy Load and Light Load Handling Systems Program<br>(BSEP AMP B.2.9) | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (GALL AMP XI.M23) | BSEP:<br><br>BNP-LR-628, "License Renewal Aging Management Program Description Of the3 Inspection of Overhead Heavy Load and Light Load Handling Systems," June 21, 2004<br><br>EGR-NGGC-0351, "Condition Monitoring of Structures," Revision 12<br><br>Plant operating Manual, Volume XII Preventive Maintenance, OPM-CRN501, "PM for the Fixed Gantry and Track Cranes," Rev. 19<br><br>Plant Operating Manual Volume XII, Preventive Maintenance, OPM-CRN502, "Maintenance Instructions for the Stearns-Rodger Refueling Platform," Revision 10<br><br>Work Order Package 00478562 01, "(ME) 1-BC-RB-Bridge-Crane, Perform the Annual Inspection of Crane," September 16, 2004.<br><br>Work Order Package 00478562 01, "(ME) 2-BC-RB-Bridge-Crane, Perform the Annual Inspection of Crane," September 3, 2004.<br><br>Work Order 00480878 01, "Mechanical "Vender and Craft to Perform Annual Inspection of Crane," August 24, 2004<br><br>Adverse Condition Investigation Form, Action Request Number: 44106/2 |

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| Fire Protection Program (BSEP AMP B.2.10) | Fire Protection (as modified by NRC ISG-04) (GALL AMP XI.M26) | BSEP:<br><br>BNP-LR-612, “License Renewal Aging Management Program Description of the Fire Protection Program,” Rev. 1<br><br>CAP-NGGC-0202, “Operating Experience Program,” Rev. 8<br><br>CAP-NGGC-0200, “Corrective Action Program,” Rev. 14<br><br>EGR-NGGC-0008, “Engineering Programs,” Rev. 5<br><br>EGR-NGGC-0504, “Mechanical System Aging Management Review for License Renewal,” Rev. 6<br><br>BNP-LR-011, “Operating Experience (OE) Review of Materials and Programs for License Renewal,” Rev. 0<br><br>0AP-033, “Fire Protection Program Manual,” Rev. 10<br><br>Fire Protection Program Review For 2001, November 13, 2001<br><br>0PT-34.6.7.10, “Fire Barrier Penetration Seals Diesel Generator Building,” Rev. 10<br><br>UFSAR, Chapter 9.5, “Other Auxiliary Systems”, Rev. 18C<br><br>BNP-LR-351,” License Renewal Aging Management Review Halon Supply System,” Rev. 0<br><br>BNP-LR-349, “License Renewal Aging Management Review $CO_2$ Supply System,” Rev. 0<br><br>0PLP-01.2, “Fire Protection System Operability, Action, and Surveillance Requirements,” Rev. 21 |

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| | | Other:<br><br>ISG-04, “Interim Staff Guidance (ISG)-04 Aging Management of Fire Protection Systems for License Renewal,” December 3, 2002<br><br>NFPA-12A, National Fire Protection Association, “Standard on Halon 1301 Fire Extinguishing Systems,” 1997 |
| Fire Water System Program<br>(BSEP AMP B.2.11) | Fire Water System (GALL AMP XI.M27) | BSEP:<br><br>BNP-LR-611, “License Renewal Aging Management Program Description of the Fire Water System Program,” Rev. 1<br><br>CAP-NGGC-0202, “Operating Experience Program,” Rev. 8<br><br>CAP-NGGC-0200, “Corrective Action Program,” Rev. 14<br><br>EGR-NGGC-0008, “Engineering Programs,” Rev. 5<br><br>EGR-NGGC-0504, “Mechanical System Aging Management Review for License Renewal,” Rev. 6<br><br>BNP-LR-011, “Operating Experience (OE) Review of Materials and Programs for License Renewal,” Rev. 0<br><br>0AP-033, “Fire Protection Program Manual,” Rev. 10<br><br>UFSAR, Chapter 9.5, “Other Auxiliary Systems”, Rev. 18C<br><br>0PLP-01.2, “Fire Protection System Operability, Action, and Surveillance Requirements,” Rev. 21<br><br>BNP-LR-004, “Fire Protection System Scoping For License Renewal,” Rev. 5 |

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| | | Other:<br><br>ISG-04, “Interim Staff Guidance (ISG)-04 Aging Management of Fire Protection Systems for License Renewal,” December 3, 2002 |
| Aboveground Carbon Steel Tanks Program (BSEP AMP B.2.12) | Aboveground Carbon Steel Program (GALL AMP XI.M29) | BSEP:<br><br>BNP-LR-630, “License Renewal Aging Management Program Description of the Aboveground Carbon Steel Tanks Program”, Rev. 1<br><br>EGR-NGGC-0351, “Condition Monitoring of Structures,” Rev. 12<br><br>CAP-NGGC-0202, “Operating Experience Program,” Rev. 8<br><br>ESR-099-00518, “Corrosion Effects on Condensate Storage Tank, Rev. 2 |
| Fuel Oil Chemistry Program (BSEP AMP B.2.13) | Fuel Oil Chemistry (GALL AMP XI.M30) | BSEP:<br><br>BNP-LR-631, “License Renewal Aging Management Program Description of the Fuel Oil Chemistry Program,” Rev. 2<br><br>OE&RC-1010, “Fuel Oil Sampling,” Rev. 24<br><br>FACTS Item 92B9806, “Fuel Oil Degradation Concerns,” February 26, 1992<br><br>UFSAR Table 1-6, “Conformance to NRC Regulatory Guides,” Rev. 18D<br><br>OE&RC-1141, “Water and Sediment in Fuel Oil,” Rev. 5<br><br>OE&RC-1142, “Particulate Contamination in Fuel Oil,” Rev. 3<br><br>69220, Nonconformance Report, April 23, 2003<br><br>FACTS Action Item Assignment #92B9806, |

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| | | February 26, 1992<br><br>69220, Adverse Condition Investigation Report, August 19. 2002<br><br>Tech Spec 5.5.9, “Diesel Fuel Oil Testing Program,” Rev. 18<br><br>AR 100627-46 Action Plan, “Fuel Oil Chemistry Program Implementation Plan,” January 27, 2005<br><br>9107, Nonconformance Report-Fuel Oil Truck Flashpoint, November 8, 1999<br><br>89622, Nonconformance Report-Fuel Oil in the APG Bldg., April 4, 2003<br><br><u>Other</u>:<br><br>ASTM D130, “Standard Test Method For Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test,” 1994<br><br>ASTM D975, “Standard Specification For Diesel Fuel Oils,” 1988<br><br>ASTM D1796, “Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure),” 1997<br><br>ASTM D2276, “Standard Test Method for Particulate Contaminant in Aviation Fuel,” 1989<br><br>API STD 653, “Tank Inspection, Repair, Alteration, and Reconstruction,” September 2003 |
| One-Time Inspection Program<br>(BSEP AMP B.2.15) | One-Time Inspection (GALL AMP XI.M32) | <u>BSEP</u>:<br><br>BNP-LR-632, “License Renewal Aging Management Program Description of the One Time Inspection Program,” Rev. 1 |

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| | | AR 100627-40, "Action Plan: One Time Inspection Program Commitment/Credited Activity Summary - Draft"<br><br>BNP-LR-600, "License Renewal Aging Management Program Description of the Water Chemistry Program," Rev. 1<br><br>BNP-LR-631, "License Renewal Aging Management Program Description of the Fuel Oil Chemistry Program," Rev. 2 |
| Selective Leaching of Materials Program (BSEP AMP B 2.16) | Selective Leaching of Materials Program (GALL AMP XI.M33) | <u>BSEP</u>:<br><br>BNP-LR-633, "License Renewal Aging Management Program Description of the Selective Leaching of Materials Program," Rev. 1<br><br>ADM-NGGC-0104, "Work Management Process," Rev. 28<br><br>CAP-NGGC-0200, "Corrective Action Program," Rev. 14<br><br>CAP-NGGC-0202, "Operating Experience Program," Rev. 8<br><br><u>Other</u>:<br><br>American Society for Metals (ASM), "Metals Handbook-Failures Analysis and Prevention," Volume 10, 8th Edition 1975<br><br>Fontana, Mars. G., "Corrosion Engineering," Third Edition 1980 |
| Buried Piping and Tanks Inspection Program (BSEP AMP B 2.17) | Buried Piping Tanks Inspection Program (GALL AMP XI.M34) | <u>BSEP</u>:<br><br>BNP-LR-634, "License Renewal Aging Management Program Description of the Buried Piping and Tanks Inspection Program," Rev. 0<br><br>CAP-NGGC-0202, "Operating Experience Program," Rev. 8 |

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| | | NGGM-PM-0007, “Quality Assurance Program Manual,” Rev. 8<br><br>PRO-NGGC-0202, “NGGC Procedure Review and Approval Process,” Rev. 15<br><br>PRO-NGGC-0204, “Procedure Review and Approval.” Rev. 6 |
| ASME Section XI, Subsection IWE Program (BSEP AMP B.2.18) | ASME Section XI, Subsection IWE (GALL AMP XI.S1) | BSEP:<br><br>BNP-LR-616, “License Renewal Aging Management Program Description of the ASME Section XI, Subsection IWE,” Rev. 1<br><br>EGR-NGGC-0015, “Containment Inspection Program,” Rev. 3<br><br>0PT-20.5.1, “Primary Containment Inspection,” Rev. 13<br><br>0BNP-TR-002, “First Containment Inspection Interval Containment Inspection Program,” Rev. 8<br><br>0ENP-16, “Procedure for Administrative Control of Inservice Inspection Activities,” Rev. 43<br><br>0PLP-08, “Repair/Replacement Program,” Rev. 22<br><br>BNP-LR-011, “Operating Experience (OE) Review of Materials and Programs for License Renewal,” Rev. 0 |
| ASME Section XI, Subsection IWL Program (BSEP AMP B.2.19) | ASME Section XI, Subsection IWL (GALL AMP XI.S2) | BSEP:<br><br>BNP-LR-617, “License Renewal Aging Management Program Description of the ASME Section XI, Subsection IWL,” Rev. 1<br><br>EGR-NGGC-0015, “Containment Inspection Program,” Rev. 3<br><br>0PT-20.5.1, “Primary Containment |

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| | | Inspection," Rev. 13<br><br>0BNP-TR-002, "First Containment Inspection Interval Containment Inspection Program," Rev. 8<br><br>0ENP-16, "Procedure for Administrative Control of Inservice Inspection Activities," Rev. 43<br><br>BNP-LR-011, "Operating Experience (OE) Review of Materials and Programs for License Renewal," Rev. 0 |
| ASME Section XI, Subsection IWF Program (BSEP AMP B.2.20) | ASME Section XI, Subsection IWF (GALL AMP XI.S3) | BSEP:<br><br>BNP-LR-618, "License Renewal Aging Management Program Description of the ASME Section XI, Subsection IWF," Rev. 0<br><br>0PLP-08, "Repair/Replacement Program," Rev. 22<br><br>0ENP-16, "Procedure for Administrative Control of Inservice Inspection Activities," Rev. 43<br><br>0ENP-16.2, "Administrative Control of ASME Section XI Non-destructive Examination Program," Rev. 16<br><br>BNP-LR-011, "Operating Experience (OE) Review of Materials and Programs for License Renewal," Rev. 0<br><br>Other:<br><br>ASME Code Case N-491-2, "Alternative Rules for Examination of Class 1, 2, 3, and MC Component Supports of Light-Water Cooled Power Plants" |
| 10 CFR Part 50, Appendix J Program (BSEP AMP B.2.21) | 10 CFR Part 50, Appendix J (GALL AMP XI.S4) | BSEP:<br><br>BNP-LR-615, "License Renewal Aging Management Program Description of the |

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| | | 10CFR 50 Appendix J Containment Leak Rate (LRT) Program," Rev. 0<br><br>OPT-20.5, "Integrated Primary Containment Leak rate Test (ILRT)," Rev. 42<br><br>OPT-20.3B, "Local Leak Rate Testing of the Personnel Airlock," Rev. 10<br><br>OPT-20.3C, "Personnel Airlock Interior and Exterior Doors Leak Rate Test," Rev. 8<br><br>OPT-20.3," Local Leak Rate Testing," Rev. 55<br><br>OPT-20.5-1, "Primary Containment Inspection," Rev. 13<br><br>OENP-16.8, "Containment Leakage Testing," Rev. 20<br><br>Technical Specifications, Section 3.6 "Containment Systems" and 5.5.12 "Primary Containment Leakage Rate Testing Program"<br><br>BNP-LR-011, "Operating Experience (OE) Review of Materials and Programs for License Renewal," Rev. 1<br><br>Assessment No. 78519, "ILRT Readiness," December 2003<br><br>Assessment No. 50949, "Appendix J-LLRT," September 2002<br><br>Assessment No. 51121, "Unit 1 ILRT Preparation Assessment," November 2001<br><br>Assessment No. ESS-98-012, "Assessment of the Local Leak Rate Testing (LLRT) Program", November 1998<br><br>Letters from WR Campbell to NRC, Brunswick Steam Electric Plant, Units 1 and 2, Supplement to Requests For License Amendments for Containment Leakage Rate Testing, Serial BSEP 95-0605, November |

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| | | 27, 1995 and January 29, 1996<br><br>Other:<br><br>Letter, NRC to JS Keenan, "BSEP Unit 1-Issuance of Amendment regarding Containment Leakage Rate Testing," March 6, 2002<br><br>Letter, NRC to JS Keenan, "BSEP Unit 2-Issuance of Amendment regarding Containment Leakage Rate Testing," November 21, 2002<br><br>RG 1.163, "Performance-Based Containment Leak-Test Program," September 1995<br><br>NEI 94-01," Industry Guidelines for Implementing Performance-Based Option of 10CFR Part 50 Appendix J," January 26, 1995 |
| Masonry Wall Program (BSEP AMP B 2.22 | Masonry Wall Program (GALL AMP XI. S5) | BSEP:<br><br>BNP-LR-662, "License Renewal Aging Management Program Description of the Masonry Wall Program," Rev. 0<br><br>LER 92-012-03, "Emergency Diesel Generator Building Internal Wall Seismic Support Bolting was Defectively Installed During Plant Construction (Supplement 3)"<br><br>EGR-NGGC-0351, "Condition Monitoring of Structures," Revision 12<br><br>CAP-NGGC-0202, "Operating Experience Program," Rev. 8 |
| Structures Monitoring Program (BSEP AMP B.2.23) | Structures Monitoring Program (GALL AMP XI.S6) | BSEP:<br><br>BNP-LR-608, "License Renewal Aging Management Program Description of the Structures Monitoring Program," Rev. 1<br><br>0E&RC-3250, "Groundwater Monitoring |

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| | | Program," Rev. 22<br><br>0E&RC-3295, 'Intake Canal Monitoring," Rev. 12<br><br>0SPP-PIX503, "Excavation and Backfill," Rev. 1<br><br>EGR-NGGC-0351, "Condition Monitoring of Structures," Rev. 12<br><br>BNP-LR-011, "Operating Experience (OE) Review of Materials and Programs for License Renewal," Rev. 0 |
| Protective Coating Monitoring and Maintenance Program (BSEP AMP B.2.24) | Protective Coating Monitoring and Maintenance Program (GALL AMP XI.S8) | BSEP:<br><br>BNP-LR-637, "License Renewal Aging Management Program Description of the Protective Coating Monitoring and Maintenance Program," July 8, 2004<br><br>Plant Operating Manual Volume X, Periodic Testing, OPT-20.5.5, "Inspection of Service Level 1 Coatings (General Visual Instruction) Revision 0," March 1, 1999<br><br>Engineering Calculation 51760, Rev 0. , "Unit 2 Coating Exempt Log," March 2003<br><br>BNP-LR-504, "Service Level 1 Coatings Time-Limited Aging Analysis (TLLA) Evaluation for License Renewal," Rev 0 (Draft)<br><br>Carolina Power & Light Company, OMISCEL-1027, "RHR/CS Strainer Debris Head Loss Analysis Post LOCA," August 15, 2000<br><br>Nuclear Generation Group OMISCEL-0010, "Volume of Insulation Debris During a LOCA," April 9, 2003 |
| Electrical Cables and Connections Not | Electrical Cables and Connections | BSEP: |

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| Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (BSEP AMP B.2.25) | Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (GALL AMP XI.E1) | BNP-LR-664, "License Renewal Aging Management Program Description of the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," Rev. 1<br><br>CAP-NGGC-0202, "Operating Experience Program," Rev. 8 |
| Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (BSEP AMP B.2.26) | Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits (GALL AMP XI.E2) | BSEP:<br><br>BNP-LR-655, "License Renewal Aging Management Program Description of the Electrical Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program," Rev. 0<br><br>CAP-NGGC-0202, "Operating Experience Program," Rev. 8 |
| Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (BSEP AMP B.2.27) | Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (GALL AMP XI.E3) | BSEP:<br><br>BNP-LR-666, "License Renewal Aging Management Program Description of the Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program," Rev. 1<br><br>CAP-NGGC-0202, "Operating Experience Program," Rev. 8 |
| Preventive Maintenance Program (BSEP AMP B.2.30) | Plant Specific Program | BSEP:<br><br>BNP-LR-642, "License Renewal Aging Management Program Description of the Preventive Maintenance Program," Rev. 1<br><br>BNP-LR-314, "License Renewal Aging Management Review, Standby Liquid Control System," Rev. 0<br><br>Standard Procedure, Volume 99, Book/Part 1, ADM-NGGC-0203, "Preventive Maintenance and Surveillance Testing Administration," Rev. 5 |

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| | | BNP-LR-318, “License Renewal Aging Management Review, High Pressure Coolant Injection System,” Rev. 2<br><br>Plant Operating Manual, Volume XX, Engineering Procedure, OENP-2704, “Administrative Controls of NRC Generic Letter 89-13 Requirements,” Rev. 8<br><br>Engineering Evaluation Report 90-0102, “SLC Accumulators Evaluation for Use Until Replacement Associated with PID-04270A&B,” Rev. 1, May 3, 1990<br><br>Work Order Package 00039294, “Track Closure OPT-09.2.4 – ASME Pressure Test of HPCI System,” January 13, 2005<br><br>Passport database system queries: PM ID of frequency of PM<br><br>Work Order Package 00038306, “HPCI Min Flow Valve to Supp Pool,” January 13, 2005<br><br>ERW 08687, “SLC Accumulator Minimum Wall Ultrasonic Testing,” January 14, 1994 |
| Reactor Coolant Pressure Boundary Fatigue Monitoring Program (BSEP AMP B.3.1) | Metal Fatigue of Reactor Coolant Pressure Boundary (GALL AMP X.M1) | <u>BSEP</u>:<br><br>BNP-LR-605, “ License Renewal Aging Management Program Description of the Reactor Coolant Pressure Boundary Fatigue Monitoring Program,” Rev. 0<br><br>0ENP-44, “Reactor Pressure Vessel Component Fatigue Monitoring Program,” Rev. 7<br><br>BNP-LR-011, “Operating Experience (OE) Review of Materials and Programs for License Renewal,” Rev. 0<br><br><u>Other</u>:<br><br>NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components”, |

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| | | March 1995 |
| Environmental Qualification (EQ) Program (BSEP AMP B.3.2) | Environmental Qualification (EQ) of Electric Components (GALL AMP X.E1) | BSEP:<br><br>BNP-LR-650, “License Renewal Aging Management Program Description of the EQ Program,” Rev. 0<br><br>CAP-NGGC-0202, “Operating Experience Program,” Rev. 8 |
| **BSEP Aging Management Review** | **Applicable SRP-LR / GALL Volume 2 Sections** | **BSEP Documents Reviewed in addition to BSEP LRA** |
| Aging Management of Reactor Vessel, Internals, and Reactor Coolant System (BSEP LRA Sect. 3.1) | 3.1 / IV | BNP-LR-302, “License Renewal Aging Management Review - Specialty Area Summary for Reactor Vessel, Internals and Reactor Coolant Systems,” Rev. 1<br><br>BNP-LR-306, “License Renewal Aging Management Review - Reactor Vessel and Internals System,” Rev. 2<br><br>BNP-LR-307, “License Renewal Aging Management Review - Neutron Monitoring System,” Rev. 1<br><br>BNP-LR-308, “License Renewal Aging Management Review - Rod Control System,” Rev. 0<br><br>BNP-LR-309, “License Renewal Aging Management Review - Control Rod Hydraulic System,” Rev. 1<br><br>BNP-LR-312, “License Renewal Aging Management Review - Reactor Coolant Recirculation System,” Rev. 1 |
| Aging Management of Engineered Safety Features (BSEP LRA Sect. 3.2) | 3.2 / V | BNP-LR-303, “License Renewal Aging Management Review - Specialty Area Summary for Engineering Safety Featrures Systems,” Rev. 1 |

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| | | BNP-LR-310, “License Renewal Aging Management Review - Reactor Protection System,” Rev. 0<br><br>BNP-LR-313, “License Renewal Aging Management Review - Core Spray System,” Rev. 1<br><br>BNP-LR-314, “License Renewal Aging Management Review - Standby Liquid Control System,” Rev. 1<br><br>BNP-LR-315, “License Renewal Aging Management Review - Residual Heat Removal System,” Rev. 1<br><br>BNP-LR-317, “License Renewal Aging Management Review - Containment Atmospheric Control System,” Rev. 1<br><br>BNP-LR-318, “License Renewal Aging Management Review - High Pressure Coolant Injection System,” Rev. 2<br><br>BNP-LR-323, “License Renewal Aging Management Review - Steam Systems,” Rev. 1<br><br>BNP-LR-359, “License Renewal Aging Management Review - Standby Gas Treatment System,” Rev. 0<br><br>BNP-LR-364, “License Renewal Aging Management Review - Reactor Building HVAC System,” Rev. 1 |
| Aging Management of Auxiliary Systems (BSEP LRA Sect. 3.3) | 3.3 / VII | BNP-LR-304, “License Renewal Aging Management Review - Specialty Area Summary for Auxiliary Systems,” Rev. 0<br><br>BNP-LR-311, “License Renewal Aging Management Review - Reactor Water Cleanup System (2010),” Rev. 0<br><br>BNP-LR-345, “License Renewal Aging Management Review - Pneumatic Systems (6135, 6152, 2055),” Rev. 1 |

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| | | BSEP Procedure Development Form for Procedure 0PT-90.11, “Boral Surveillance Sample Testing,” Rev. 9 |
| Aging Management of Steam and Power Conversion Systems (BSEP LRA Sect. 3.4) | 3.4 / VIII | BNP-LR-327, “Condensate Systems (3070, 3077, 3080, 4005, 4010),” Rev. 0<br><br>Plant Operating Manual, Volume III, Operating Procedures, 0OP-40, Auxiliary Steam System,” Rev 59 |
| Aging Management of Containments, Structures and Component Supports (BSEP LRA Sect. 3.5) | 3.5 / II, III | None. |
| Aging Management of Electrical and Instrumentation and Controls (BSEP LRA Sect. 3.6) | 3.6 / VI | None. |
| **BSEP TLAA Evaluation** | **Applicable SRP-LR Section** | **BSEP Documents Reviewed in addition to BSEP LRA** |
| Analysis of Radiation Degradation of Service Level 1 Coatings Inside Primary Containment (BSEP LRA Sect. 4.7) | 4.7 | BNP-LR-504, “Service Level 1 Coatings Time-Limited Aging Analysis (TLLA) Evaluation for License Renewal,” Rev 0 (Draft) |

**ATTACHMENT 6: List of Commitments to Be Included in Appendix A of the Safety Evaluation Report**

In responses to project team questions (as documented in letters dated March 14, 2005 [ML050810493], March 31, 2005 [ML050970259], and May 4, 2005 [ML051330020]), the applicant clarified several BSEP LRA commitments, revised several BSEP LRA commitments, and corrected several technical errors in the BSEP LRA. The information provided in these responses either augments or supersedes (where applicable) the information provided in the applicant's BSEP LRA submittal.

| Audit Question No. | Audit Report Section | Applicant's Response |
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| 3.1-1 | 3.1.1.2 | Initial screening for material susceptibility to thermal embrittlement of the main steam line flow limiters and reactor coolant recirculation pump discharge flow elements has been completed. It has been determined that these components are not susceptible to reduction of fracture toughness due to thermal aging embrittlement. The affected AMRs will be updated to reflect this, and the One-Time Inspection Program will be updated to remove these components from the program. |
| 3.2-4 | 3.2.1.1 | The Bolting Integrity Program will be revised to include ASME, Section XI, activities identified in GALL, as well as aspects of monitoring and trending under Systems Monitoring for bolted connections outside of ASME, Section XI, boundaries. Subsequent to these revisions, the Bolting Integrity Program will be consistent with GALL with the exception that structural bolting is not addressed.<br><br>Additionally, aging management review summaries in Sections 3.1, 3.2, 3.3, and 3.4 will be revised to address aging management requirements for each of the aging effects identified in GALL AMR line items pertaining to closure bolting in high pressure or high temperature systems. |
| 3.4-1 | 3.4.1.5 | The Main Condensers were placed in scope due to application of the Alternative Source Term. The Main Condensers were inadvertently given intended functions M-1 and M-7. Intended function M-7, providing holdup and plateout of Main Steam Isolation Valve (MSIV) leakage, is the appropriate function for the Main Condensers in the Alternative Source Term role; whereas, M-1, pressure boundary, is not an appropriate intended function.<br><br>Table 2.3.4-5 and Table 3.4.2-5 currently state the Main |

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| | | Condenser components have intended functions M-1 and M-7. These Tables will be corrected to show that the Main Condenser tubes, tube sheet, and shell have an intended function of M-7 only. Item 3.4.1-05, Item 3.4.1-09, and Subsection 3.4.2.2.4 will have "pressure boundary" removed. Discussion of "pressure boundary" will be revised in plant-specific Note 404. |
| 3.6-2 | 3.6.1.1 | Non EQ Insulated Cable and Connections in Table 3.6.2-1, "radiolysis and photolysis (UV sensitive materials only) of organics" was omitted from aging effect requiring management. NUREG-1801, Volume 2,identifies this aging effect. The AMR table will be revised to include this aging effect for this commodity group. |
| B.2.1-1 | 2.1.2 | BSEP will comply with 10 CFR 50.55a for the extended period of operation. The ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD program description to be integrated into the Updated Final Safety Analysis Report (UFSAR), in BSEP LRA, Appendix A, Section A.1.1.1, will be revised to omit reference to Risk-Informed Inservice Inspection (RI-ISI) as a part of the program and information concerning the details of a specific inspection interval. |
| B.2.2-6 | 2.2.2 | BSEP aging management reviews have identified that the Demineralized Water (MUD) Tank is constructed of aluminum, and potentially susceptible to crevice, pitting and galvanic corrosion. BSEP had specified the Water Chemistry Program, augmented by the One-Time Inspection Program, to address this aging effect. BSEP performs routine internal visual inspections of the MUD Tank to ensure the tank is not experiencing corrosion.<br><br>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. |
| B.2.7-1 | 2.7.6 | The BSEP Open Cycle Cooling Water (OCCW) Program will be revised to include performance testing of the Residual Heat Removal (RHR) and Emergency Diesel Generator Jacket Water heat exchangers prior to the period of extended operation. The results from these testing activities will be evaluated and used to prescribe testing / inspection requirements needed to ensure system functionality during the period of extended operation. This response results in a change to the enhancements provided in the second paragraph of the description of the OCCW Program in BSEP |

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| | | LRA, Appendix A, Section A.1.1.7. The change would incorporate new enhancement number six to read:<br><br>(6) Performance testing of the RHR and Emergency Diesel Generator Jacket Water heat exchangers will be performed to verify heat transfer capability. |
| B.2.15-1 ; B.2.15-1a | 2.14.3 | 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.<br><br>The discussion will no longer reference or credit RI-ISI for aging management. BSEP credits the ASME Section XI, Inservice Inspection, Subsections IWB, IWC and IWD Program and the Water Chemistry Program for aging management, and use the One-Time Inspection Program for verification of program effectiveness, consistent with the recommendations of GALL. |
| B.2.17-1 | 2.16.3 | BSEP will revise the Buried Piping and Tanks Inspection Program to do periodic inspections of buried piping. Opportunistic inspection may be used to satisfy inspection requirements, but in no case will the frequency of inspection exceed 10 years. |
| B.2.23-1 | 2.22.4 | Periodic groundwater monitoring is currently being performed under Section 10.7 of implementing procedure 0E&RC-3250 and will be continued during the period of extended operation. An enhancement to the Structures Monitoring Program implementing procedure EGR-NGGC-0351 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. |
| B.2.23-2 | 2.22.2 | Prior to the period of extended operation, the Structures Monitoring Program will be enhanced to, for example: (1) identify License Renewal systems managed by the Program, (2) require notification of the responsible engineer regarding availability of exposed below-grade concrete for inspection, (3) include inspections of the submerged portions of the Service Water Intake Structure on a frequency not to exceed five years, (4) specify an annual groundwater monitoring inspection frequency for concrete structures, and (5) specify the inspection frequency for the Service Water Intake Structure and Intake Canal to not exceed five years. |

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| B.2.26-1 | 2.25.2 | 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. |
| B.2.27-1 | 2.26.2 | In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested at least once every 10 years as stated in Section A.1.1.27 of Appendix A and Section B.2.27 of Appendix B of the BSEP LRA. This frequency is consistent with that recommended in Section XI.E3 of NUREG-1801.<br><br>The medium-voltage License Renewal manholes will be inspected and accumulated water will be removed by the Preventive Maintenance Program. The inspection frequency will be based on actual field data and shall not exceed two years. |
| B.3.1-1 | 2.28.3 | The BSEP 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. |