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**Date:** Fri, Jun 30, 2006 4:52 PM
**Subject:** Draft AMP section of Audit report

Pilgrim Team:

Attached are two documents -- The first is the initial draft of the Pilgrim AMP audit with the comments from the project team incorporated -- The second is a comment form for your use.

Please review the draft Pilgrim audit report and make your comments on the attached comment form.

Thank you for your cooperation.

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**Mail Envelope Properties** (44A58F01.AF0 : 16 : 2800)

**Subject:** Draft AMP section of Audit report
**Creation Date** Fri, Jun 30, 2006 4:51 PM
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| **Post Office** | **Route** |
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| TEXT.htm | 2236 | |
| Draft Audit Report 6-30-06.pdf | 1042421 | |
| comment form.wpd | 15553 | |
| Mime.822 | 1453723 | |

**Options**

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| **Priority:** | Standard |
| **ReplyRequested:** | No |
| **Return Notification:** | None |
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| **Concealed Subject:** | No |
| **Security:** | Standard |

**Junk Mail Handling Evaluation Results**
Message is eligible for Junk Mail handling
This message was not classified as Junk Mail

**Junk Mail settings when this message was delivered**
Junk Mail handling disabled by User
Junk Mail handling disabled by Administrator
Junk List is not enabled
Junk Mail using personal address books is not enabled
Block List is not enabled

**Audit and Review Report for**

**Plant Aging Management Reviews**

**and Programs**

**Pilgrim Nuclear Power Station**
**Docket No.:**

[DATE]



Revision 0

Prepared by
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U.S. Nuclear Regulatory Commission
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**Pilgrim Nuclear Power Station Audit and Review Report**

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**Pilgrim Nuclear Power Station Audit and Review Report**

**Pilgrim Nuclear Power Station Audit and Review Report**

**Audit and Review Report for Plant Aging Management Reviews and Programs For Pilgrim Nuclear Power Station**

## 1. Introduction and General Information

### 1.0 Introduction

By letter dated January 25, 2006 (Agencywide Documents Access and Management System [ADAMS] ADAMS Accession Number ML060300028), Entergy Nuclear Generation Company (Entergy, the applicant) submitted to the U.S. Nuclear Regulatory Commission (NRC) its application for renewal of Facility Operating License No. DPR-35 for Pilgrim Nuclear Power Station (ADAMS Accession Number ML011920392). The applicant requested renewal of its operating license for an additional 20 years beyond the 40-year current license term.

In support of the staff's safety review of the license renewal application (LRA) for Pilgrim Nuclear Power Station (PNPS), the License Renewal Branch C (RLRC) 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 PNPS. The project team included both NRC staff and contractor personnel provided by Advanced Technologies and Laboratories International, Inc. (ATL), the RLRC technical contractor. Attachment 2 lists the project team members as well as other NRC staff and ATL personnel who supported the project team's audit and review.

The project team performed its work in accordance with the requirements of Title 10 of the Code of Federal Regulations (CFR), Part 54 (10 CFR Part 54), Requirements for Renewal of Operating Licenses for Nuclear Power Plants; the guidance provided in Revision 1 of NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR); and the guidance provided in Revision 1 of NUREG-1801, Generic Aging Lessons Learned (GALL) Report, (GALL Report).

Details of how the project team implemented these requirements and guidance are found in "Audit and Review Plan for Plant Aging Management Reviews and Programs - Pilgrim Nuclear Power Station," Docket No. _____, (ADAMS Accession Number______) (PNPS audit and review plan).

Overall, for its assigned scope of work, the project team 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 Pilgrim Nuclear Power Station during 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 Advanced Technologies and Laboratories International, Inc., offices in Germantown, Maryland; and at the applicant's offices (PNPS site) in White Plains, New York. The project team conducted onsite visits during the weeks of May 22, 2006, and June 19, 2006. The project team conducted a public exit meeting at the applicant's offices in White Plains, New York, on July 27, 2006.

Attachment 2 lists the applicant personnel and other individuals contacted by the project team in support of the work documented in this audit and review report. It also lists those attending the public exit meeting. [If applicable use the next sentence, if not, delete it.] Attachment 2A lists members of the public that attended the public exit meeting.

### 1.1 Background

In 10 CFR54.4, 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.

In addition, 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 bases 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/aging mechanisms 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 NRC-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 review of the substance of the matters described in the GALL Report. Rather, the staff determines that the applicant established that the approvals set forth in the GALL Report apply to its programs.

If an applicant takes credit for a GALL Report program, it is incumbent on the applicant to ensure that its plant program addresses all 10 program elements of the referenced GALL Report program. 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 Report program was evaluated. The applicant must certify in its LRA that it completed the appropriate verifications and that those verifications are documented and retained by the applicant in an auditable form.

## 2. Audit and Review Scope

The AMRs and associated AMPs that the project team reviewed are identified in the PNPS audit and review plan. The project team examined [NUMBER][number of AMPs reviewed] of the PNPS AMPs and associated AMRs. The project team reviewed AMPs and AMRs that the applicant claimed were consistent with the GALL Report and AMRs for which further evaluation is recommended by the GALL Report. The project team also reviewed certain plant-specific AMPs. [confirm with PM assigned AMP list.]

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 Report recommendations that the applicant does not intend to implement.

- enhancements - enhancements include those actions/activities necessary to (1) ensure consistency with GALL Report AMP recommendations or (2) provide additional features to the program 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's audit and review activities for the PNPS AMPs and its conclusions regarding these reviews are documented in Section 3.0.3 of this audit and review report.

The project team reviewed all PNPS LRA Table 2s[1] AMR line-items in Chapter 3, except those that were assigned to the Office of Nuclear Reactor Regulation (NRR), Division of Engineering (DE) staff. [confirm with PM assigned AMP list] Those the project team reviewed were either consistent with the GALL Report, as identified by Notes A through E in PNPS LRA Table 3.X.2-Y (from Column 9 of the Table 2s discussed in Section 3.0.1 of this audit and review report), or reviewed and accepted by the project team on the basis of an NRC-approved precedent (see Section 3.0.2.3 of this audit and review report).

The project team determined that the AMR results, reported by the applicant to be consistent

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[1]Table2 provides detailed results of the AMRs for those components identified in the LRA Section 2 as being subject to an AMR.

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

The AMR results that are within the scope of the project team are identified in Appendix D of the PNPS audit and review plan. These AMR result line-items reviewed by the project team in Chapter 3 of the PNPS LRA Tables 3.X.2-Y were either consistent with the GALL Report or justified by the applicant on the basis of a NRC-approved precedent.

In PNPS 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, any aging effects 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 its PNPS LRA.

Note A indicates that the PNPS AMR line-item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the PNPS AMP is consistent with the AMP identified in the GALL Report.

Note B indicates that the PNPS AMR line-item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the PNPS AMP takes some exceptions to the AMP identified in the GALL Report. The project team concluded that the identified exceptions to the GALL Report AMPs are acceptable.

Note C indicates that the component for the PNPS 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 PNPS AMR line-item of the different component was applicable to the component under review.

Note D indicates that the component for the PNPS AMR line-item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the PNPS AMP takes some exceptions to the AMP identified in the GALL Report. The project team reviewed these line-items to confirm consistency with the GALL Report. The project team concluded that the PNPS 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 Report AMPs are acceptable.

Note E indicates that the PNPS 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 discovered by the project team during the audit and review that required a response are documented in this audit and review report. If resolution of an issue was not resolved 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 safety evaluation report (SER) related to the PNPS 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 PNPS LRA and program bases documents, which are available at the applicant's office, and through interviews with PNPS technical staff. The project team determined that the applicable aging effects were identified, the appropriate combination of materials and environments were listed, and acceptable AMPs were specified.

The AMR results review of PNPS LRA Sections 3.1 through 3.6 reviewed by the project team are provided in Sections 3.1 through 3.6 of this audit and review report.

## 3. Aging Management Review Audit and Review Results

This section of the audit and review report contains the project team's evaluation of the PNPS AMPs and AMRs. In PNPS LRA Appendix B, the applicant described the AMPs that it relies on to manage or monitor the aging of long-lived, passive components and structures.

In PNPS LRA Section 3, the applicant provided the results of the AMRs for those structures and components that it identifies in PNPS LRA Section 2 as being within the scope of license renewal and subject to an AMR.

**Pilgrim Nuclear Power Station Audit and Review Report**

## 3.0 PNPS's Use of the Generic Aging Lessons-Learned Report

In preparing its PNPS LRA, Entergy credited the GALL Report. The GALL Report contains the staff's generic evaluation of the existing plant programs, and 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 for license renewal without change. The GALL Report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. PNPS references the GALL Report in its LRA to demonstrate that the programs at its facility correspond to those recommended in the GALL Report.

### 3.0.1 Format of the PNPS License Renewal Application

The PNPS LRA closely follows the standard LRA format presented in Nuclear Energy Institute (NEI) guidance, NEI 95-10, *Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule*, Revision 6.

The organization of Section 3 of the PNPS LRA parallels Chapter 3 of the SRP-LR. Section 3 of the PNPS LRA provides the results of the AMPs for SCs that the applicant identified as subject to an AMR. Organization of this section is based on Tables 1 through 6 of Volume 1, Rev 1 of NUREG-1801, Generic Aging Lessons Learned (GALL), dated September 2005 (the GALL Report), and Chapter 3, "Aging Management Review Results," of Rev 1 of NUREG-1800, *Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants* (SRP-LR), dated September 2005.

This section provides the results of the aging management reviews (AMRs) for structures and components identified in Section 2 as subject to aging management review. Tables 3.0-1, 3.0-2, and 3.0-3 provide descriptions of the mechanical, structural, and electrical service environments, respectively, used in the AMRs to determine aging effects requiring management.

The results of the AMRs are presented in two table types. The first table type is Table 3.X.1 (Table 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 Systems subsection, this is Table 3.1.1, and in the Engineered Safety Features subsection, this is Table 3.2.1.

**Definition Table**

| X | Definition |
|---|---|
| 1 | Reactor Vessel, Internals, and Reactor Coolant Systems |
| 2 | Engineered Safety Features |

| | |
|---|---|
| 3 | Auxiliary Systems |
| 4 | Steam and Power Conversion System |
| 5 | Containment, Structures, Component Supports, and Piping and Component Insulation |
| 6 | Electrical Components |

The second table type is Table 3.X.2-Y, (Table 2) where "3" again indicates the PNPS 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 vessel, internals, and reactor coolant systems subsection, the AMR results for the Isolation Condenser System are presented in Table 3.1.2.1.1, and the results for the Nuclear Boiler Instrumentation System are in Table 3.1.2.1.2. In the engineered safety features subsection, the containment spray system results are presented in Table 3.2.2.1.1, and the Core Spray System results are in Table 3.2.2.1.2.

The applicant compared the PNPS AMR results with information set forth in the tables of the GALL Report and provided the results of its comparisons in two table types that correspond to the two table types described above.



**3.0.1.1 Overview of PNPS LRA Table 1**

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

**3.0.1.2 Overview of PNPS LRA Table 2**

The PNPS LRA Table 3.X.2-Y (Table 2) provides the detailed results of the AMRs for those components identified in PNPS 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 Vessel, Internals, and Reactor Coolant Systems, Engineered Safety Features, Auxiliary Systems, etc.). For example, the Engineered Safety Features system group contains tables specific to Containment Spray System, Core Spray System, and Standby Gas Treatment System. 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 PNPS 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, Table 3.0-2, and Table 3.0-3 for mechanical, structural, and electrical components, respectively.

(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 PNPS LRA with the GALL Report by noting the appropriate GALL Report AMR line-item. 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 AMR line-item 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 AMR line-item 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 AMR 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 PNPS. The letter notes are described in detail in Section 2 of this audit and review report.

### 3.0.2 Audit and Review Process

The project team performed the audit and review in accordance with the criteria defined in Revision 1 of NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, (SRP-LR). Additional details on how the SRP-LR criteria were addressed are provided in the PNPS audit and review plan. This review process is summarized in this section.



#### 3.0.2.1 Review of the PNPS AMPs

For the PNPS AMPs for which the applicant claimed consistency with the AMPs in the GALL Report, the project team determined consistency. The project team reviewed the PNPS AMP descriptions and compared the 10 program elements for those AMPs to the corresponding program elements for the GALL Report AMPs (Attachment 3 shows the 10 aging management program elements from the SRP-LR). The Division of Engineering (DE) reviewed and determined the adequacy of the applicant's 10 CFR 50, Appendix B Program and the results documented in Section 3 of the safety evaluation report (SER) related to the PNPS LRA.

For the PNPS 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 PNPS 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 PNPS AMPs credited by the applicant and the GALL Report 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 PNPS AMPs that are not included in the GALL Report, the project team reviewed the PNPS AMP against the program elements specified in Appendix A.1 of the SRP-LR. The project team determined whether these PNPS AMPs would manage the aging effects for which they are credited.

#### 3.0.2.2 Review of the PNPS AMR Results

The AMRs in the GALL Report fall into two broad 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 determined that the PNPS AMR results, reported by the applicant to be consistent with the GALL Report, are consistent with the GALL Report. The project team also determined that the plant-specific AMR results reported by the applicant to be justified on the basis of an NRC-approved precedent are technically acceptable and applicable. For AMR 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.

### 3.0.2.3 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 NRC has approved for other plants during its review of previous applications for license renewal. When an applicant elected to provide precedent information, the project team determined whether the material presented in the precedent was applicable to the applicant's facility, determined whether the plant program was bound by the conditions for which the precedent was evaluated and approved, and determined that the plant program contained the program elements of the referenced precedent. In general, if the project team determined that these conditions were satisfied, it used 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 the applicant's 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 determined that a precedent identified by the applicant was not applicable to the particular plant program for which it is credited, it may have referred the program to NRR DE for review in the traditional manner (i.e., as described in the SRP-LR) without consideration of the precedent information.

Entergy chose not to use precedent information to support its selection of PNPS's programs.

### 3.0.2.4 Updated Final Safety Analysis Review Supplement

Consistent with the SRP-LR, for the AMR 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).

### 3.0.2.5 Documentation and Documents Reviewed

In performing its work, the project team relied heavily on the PNPS LRA, the SRP-LR, and the GALL Report. The project team also reviewed the applicant's AMP bases documents (a catalog of the documentation used by the applicant to develop or justify its AMPs), and other onsite documents, including selected implementing documents, 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, an 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 PNPS 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 audit and review, the project team also conducted detailed discussions and interviews with the applicant's license renewal project personnel and other personnel with technical expertise relevant to aging management.



### 3.0.2.6 Commitments To Be Included In the Safety Evaluation Report

During the audit and review, 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 SSCs within the scope of license renewal. A list of these commitments is included in Attachment 6 of this audit and review report.

### 3.0.2.7 Exit Meeting

The project team held a public exit meeting with the applicant on July 27, 2006, to discuss the results of its audits and reviews of the AMPs and AMR 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.

### 3.0.3 PNPS Aging Management Programs

The project team's audit and review activities for the PNPS AMPs and its conclusions regarding these programs are documented below. The audit and review was performed in accordance with the guidance contained in the PNPS audit and review plan as summarized in Section 3.0.2

of this audit and review report.

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

**Table 3.0.3-1 PNPS's Aging Management Programs**

| PNPS's AMP (LRA Section) | GALL Report Comparison | GALL Report AMP(s) | PNPS LRA Systems or Structures That Credit the AMP | Project Team's Evaluation Section |
|---|---|---|---|---|
| Boraflex Monitoring Program (B.1.1) | Consistent | XI.M22, Boraflex Monitoring | | 3.0.3.1.1 |
| Buried Piping and Tanks Inspection Program (B.1.2) | Consistent with exception | XI.M34, Buried Piping and Tanks Inspection | | 3.0.3.2.1 |
| BWR Control Rod Drive Return Line Nozzle Program (B.1.3) | Consistent with exception | XI.M6, BWR CRD Return Line Nozzle | | 3.0.3.2.2 |
| BWR Feedwater Nozzle Program (B.1.4) | Consistent with exception | XI.M5, BWR Feedwater Nozzle | | 3.0.3.2.3 |
| BWR Penetrations Program (B.1.5) | Consistent with exception | XI.M8, BWR Penetrations | | 3.0.3.2.4 |
| BWR Stress Corrosion Cracking Program (B.1.6) | Consistent with exception and enhancement | XI.M7, BWR Stress Corrosion Cracking | | 3.0.3.2.5 |
| BWR Vessel ID Attachment Welds Program (B.1.7) | Consistent with exception | XI.M4, BWR Vessel ID Attachment Welds | | 3.0.3.2.6 |
| BWR Vessel Internals Program (B.1.8) | Consistent with exception and enhancement | XI.M9, BWR Vessel Internals | | 3.0.3.2.7 |
| Containment Leak Rate Program (B.1.9) | Consistent | XI.S4, 10 CFR 50, Appendix J | | 3.0.3.1.2 |
| Diesel Fuel Monitoring Program (B.1.10) | Consistent with exception and enhancement | XI.M30, Fuel Oil Chemistry | | 3.0.3.2.8 |

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| PNPS's AMP (LRA Section) | GALL Report Comparison | GALL Report AMP(s) | PNPS LRA Systems or Structures That Credit the AMP | Project Team's Evaluation Section |
|---|---|---|---|---|
| Environmental Qualification (EQ) of Electric Components Program (B.1.11) | Consistent | XI.E1, EQ of Electric Components | | 3.0.3.1.3 |
| Fatigue Monitoring Program (B.1.12) | Consistent with exception | X.M1, Metal Fatigue of Reactor Coolant Pressure | | 3.0.3.2.9 |
| Fire Protection Program (B.1.13.1) | Consistent with exception and enhancement | XI.M26, Fire Protection | | 3.0.3.2.10 |
| Fire Water System Program (B.1.13.2) | Consistent with exception and enhancement | XI.M27, Fire Water System | | 3.0.3.2.11 |
| Flow-Accelerated Corrosion Program (B.1.14) | Consistent | XI.M17, Flow-Accelerated Corrosion | | 3.0.3.1.4 |
| Heat Exchanger Monitoring Program (B.1.15) | | | | 3.0.3.3.1 |
| Containment Inservice Inspection Program (B.1.16.1) | | | | 3.0.3.3.2 |
| Inservice Inspection Program (B.1.16.2) | | | | 3.0.3.3.3 |
| Instrument Air Quality Program (B.1.17) | | | | 3.0.3.3.4 |
| Metal-Enclosed Bus Inspection Program (B.1.18) | Consistent with exception | XI.E4, Metal-Enclosed Bus | | 3.0.3.2.12 |
| Non-EQ Inaccessible Medium-Voltage Cable Program (B.1.19) | Consistent | XI.E3, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements | | 3.0.3.1.5 |

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| PNPS's AMP (LRA Section) | GALL Report Comparison | GALL Report AMP(s) | PNPS LRA Systems or Structures That Credit the AMP | Project Team's Evaluation Section |
|---|---|---|---|---|
| Non-EQ Instrumentation Circuits Test Review Program (B.1.20) | Consistent | XI.E2, Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements | | 3.0.3.1.6 |
| Non-EQ Insulated Cables and Connections Program (B.1.21) | Consistent | XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements | | 3.0.3.1.7 |
| Oil Analysis Program (B.1.22) | Consistent with exception and enhancement | XI.M39, Lubricating Oil Analysis | | 3.0.3.2.13 |
| One-Time Inspection Program (B.1.23) | Consistent | XI.M32, One-Time Inspection | | 3.0.3.1.8 |
| Periodic Surveillance and Preventive Maintenance (B.1.24) | | | | 3.0.3.3.5 |
| Reactor Head Closure Studs Program (B.1.25) | Consistent with exception | XI.M3, Reactor Head Closure Studs | | 3.0.3.2.14 |
| Reactor Vessel Surveillance Program (B.1.26) | Consistent with enhancement | XI.M31, Reactor Vessel Surveillance | | 3.0.3.2.15 |
| Selective Leaching Program (B.1.27) | Consistent | XI.M33, Selective Leaching of Materials | | 3.0.3.1.9 |
| Service Water Integrity Program (B.1.28) | Consistent with exception | XI.M20, Open-Cycle Cooling Water System | | 3.0.3.2.16 |
| Masonry Wall Program (B.1.29.1) | Consistent | XI.S5, Masonry Wall | | 3.0.3.1.10 |

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| PNPS's AMP (LRA Section) | GALL Report Comparison | GALL Report AMP(s) | PNPS LRA Systems or Structures That Credit the AMP | Project Team's Evaluation Section |
|---|---|---|---|---|
| Structures Monitoring Program (B.1.29.2) | Consistent with enhancement | XI.S6, Structures Monitoring | | 3.0.3.2.17 |
| Water Control Structures Monitoring Program (B.1.29.3) | Consistent with enhancement | XI.S7, RG 1.127, Inspection of Water-Control Structures | | 3.0.3.2.18 |
| System Walkdown Program (B.1.30) | Consistent | XI.M36, External Surfaces Monitoring | | 3.0.3.1.11 |
| Thermal Aging and Neutron Irradiation Embrittlement of CASS Program (B.1.31) | Consistent | XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of CASS | | 3.0.3.1.12 |
| Water Chemistry Control – Auxiliary Systems (B.1.32.1) | | | | 3.0.3.3.6 |
| Water Chemistry Control – BWR (B.1.32.2) | XI.M2, Water Chemistry | Consistent | | 3.0.3.1.13 |
| Water Chemistry Control – Closed Cooling Water (B.1.32.3) | XI.M21, Closed-Cycle Cooling Water System | Consistent with exception | | 3.0.3.2.19 |

### 3.0.3.1 PNPS AMPs That Are Consistent with the GALL Report

3.0.3.1.1 <u>BORAFLEX MONITORING PROGRAM (PNPS AMP B.1.1)</u>

In PNPS LRA, Appendix B, Section B.1.1, the applicant stated that PNPS AMP B.1.1, "the Boraflex Monitoring Program," is consistent with GALL AMP XI.M22, "Boraflex Monitoring."

3.0.3.1.1.1 <u>Program Description</u>

The applicant stated, in the PNPS LRA, that this program assures that degradation of the Boraflex panels in the spent fuel racks does not compromise the criticality analysis in support of the design of the spent fuel storage racks. The program relies on periodic inspection of the Boraflex, monitoring of silica levels in the spent fuel pool water, and analysis of criticality to assure that the required 5-percent subcriticality margin is maintained. The program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

3.0.3.1.1.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.1 is consistent with GALL AMP XI.M22.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.1, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.1 "Boraflex Monitoring Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M22. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.1 and associated bases documents to determine consistency with GALL AMP XI.M22.

During the audit and review, the project team noted that the applicant's LRPD-02, Section 4.1 did not distinguish the Boron-10 Areal Density Gage for Evaluating Racks (BADGER) test from the blackness testing. The project team asked the applicant to clarify that the BADGER test used in PNPS is an areal density measurement. The applicant responded that its LRPD-02, Sections 4.1.B.2b and 4.1.B.4b will be revised to clarify that BADGER test is an areal density measurement.



The project team reviewed those portions of the applicant's Boraflex Monitoring Program for which the applicant claims consistency with GALL AMP XI.M22 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Boraflex Monitoring Program provided reasonable assurance that the effects of aging will be managed during the period of extended operation. The project team found the applicant's Boraflex Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.M22, "Boraflex Monitoring."

3.0.3.1.1.3 Exceptions to the GALL Report

None.

3.0.3.1.1.4 Enhancements

None.

3.0.3.1.1.5 Operating Experience

The applicant stated, in the PNPS LRA, that blackness testing was performed on Boraflex panels in the spent fuel storage racks during 1996 and 1998 to provide a baseline for development of the monitoring program and assure that the required 5 percent subcriticality margin is maintained. Results of the 1996 testing showed shrinkage and gapping in the

Boraflex, but did not indicate erosion of the Boraflex was occurring. Analysis of the criticality design of the fuel pool based on the observed gap sizes and locations showed a very minor and negligible effect of the gaps on rack reactivity. Therefore, the pool subcriticality margin was greater than 5 percent. Results of the 1998 testing showed about a 20-percent increase in average gap size, but overall shrinkage (gaps and end shortening) of the material was much less on a percentage change basis. There were no very large gaps, and the report concluded that the Boraflex poison material in the spent fuel storage racks continues to perform its intended function.

The applicant also stated, in the PNPS LRA, that the Boraflex Monitoring Program at PNPS has been instituted recently. Therefore, there is no additional plant-specific operating experience.

During the audit and review, the project team asked the applicant to clarify that its spent fuel pool subcriticality margin of greater than 5 percent is not simply dependent on the blackness test results. In its letter dated **July xx, 2006 (MIxxxx)**, the applicant stated that LRA Section B.1.1, Operating Experience, will be revised to indicate that the result of an in-situ areal density test using the BADGER device will also be used to demonstrate the pool subcriticality margin of greater than 5 percent, as shown below:

[Provide applicant's response to the new AMP Question.]

The project team also reviewed the operating experience provided in the PNPS 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.

The project team recognized that the corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

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 concluded that the applicant's Boraflex Monitoring Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.1.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Boraflex Monitoring Program in PNPS LRA, Appendix A, Section A.2.1.1, which states that the Boraflex Monitoring Program assures that degradation of the Boraflex panels in the spent fuel racks does not compromise the criticality analysis in support of the design of the spent fuel storage racks. The program relies on (1) neutron attenuation testing, (2) determination of boron loss through correlation of silica levels in spent fuel pool water samples and periodic areal density measurements, and (3) analysis of criticality to assure that the required 5-percent subcriticality margin is maintained.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.1, found that it was

consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.1.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 CONTAINMENT LEAK RATE PROGRAM (PNPS AMP B.1.9)

In PNPS LRA, Appendix B, Section B.1.9, the applicant stated that PNPS AMP B.1.9, "Containment Leak Rate Program," is an existing plant program that is consistent with GALL AMP XI.S4, "10 CFR 50, Appendix J."



3.0.3.1.2.1 Program Description

The applicant stated, in the PNPS LRA, that containment leak rate tests are required to assure that (a) leakage through primary reactor containment and systems and components penetrating primary containment shall not exceed allowable values specified in technical specifications or associated bases and (b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of containment, and systems and components penetrating primary containment.

3.0.3.1.2.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.9 is consistent with 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 audit and review report for PNPS AMP B.1.9, including LRPD-02 Aging Management Program Evaluation Report" Revision 1, Section 4.8 "Containment Leak Rate Program", which provides an assessment of the AMP elements' consistency with GALL AMP XI.S4. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.9 and associated bases documents to determine consistency with GALL AMP XI.S4.

The project team also reviewed the following PNPS procedures: 8.7.1.3, "Local Leak Rate Test Program," Revision 21; 8.7.1.3.1 "Performance-Based Leakage Testing of the Primary Containment," Revision 2; 8.7.1.4.2 "Primary Containment Integrated Leakage Rate Test," Revision 13.

The project team reviewed those portions of the applicant's Containment Leak Rate Program for which the applicant claims consistency with GALL AMP XI.S4 and found that the PNPS program utilizes Option B and the guidance in NRC Regulatory Guide 1.163 and NEI 94-01. During the most recent integrated leakage testing of primary containment performed in 1995, as found and as left test data met all applicable test acceptance criteria. QA audits in 2000 and 2005 revealed no issues or findings that could impact effectiveness of the program. The current integrated leakage rate test periodic interval is 15 years (no later than May 25, 2010) based on Amendment 213 to the PNPS Technical Specifications, which allowed a 5-year extension to the 10-year interval. With that, they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Containment Leak Rate Program provided reasonable assurance that the Containment Leak Rate Program will be adequately managed for the period of extended operation. The project team found the applicant's Containment Leak Rate Program acceptable because it conforms to the recommended GALL AMP XI.S4, 10 CFR 50, Appendix J.

3.0.3.1.2.3 Exceptions to the GALL Report

None.

3.0.3.1.2.4 Enhancements



None.

3.0.3.1.2.5 Operating Experience

The applicant stated, in the PNPS LRA, that during the most recent integrated leakage testing of primary containment, as-found and as-left test data met all applicable test acceptance criteria, indicating that the program is effective at managing the effects of loss of material and cracking on primary containment components. QA audits in 2000 and 2005 revealed no issues or findings that could impact effectiveness of the program.

The project team also reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Containment Leak Rate Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.2.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Containment Leak Rate Program in PNPS LRA, Appendix A, Section A.2.1.9, which states that containment leak rate tests are required to assure that (a) leakage through primary reactor containment and systems and components penetrating primary containment shall not exceed allowable values specified in technical specifications or associated bases and (b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of containment, and systems and components penetrating primary containment. Corrective actions are taken if leakage rates exceed acceptance criteria.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.9, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.2.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).



3.0.3.1.3 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRIC COMPONENTS PROGRAM (PNPS AMP B.1.11)

In PNPS LRA, Appendix B, Section B1.11, the applicant stated that PNPS AMP B1.11, "Environmental Qualification (EQ) of Electric Components Program," is an existing plant program that is consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

3.0.3.1.3.1 Program Description

The applicant stated, in the PNPS LRA, that the U.S. Nuclear Regulatory Commission (NRC) has established nuclear station environmental qualification (EQ) requirements in 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments (i.e., those areas of the plant that could be subject to the harsh environmental effects of a loss of coolant accident [LOCA], high-energy line breaks [HELBs], or post-LOCA radiation) are qualified to perform their safety function in those harsh environments. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification.

The PNPS EQ program manages the effects of thermal, radiation, and cyclic 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 refurbished, replaced, or their qualification is extended prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components are considered time-limited aging analyses (TLAAs) for license renewal.

3.0.3.1.3.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B1.11 is consistent with 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 audit and review report PNPS AMP B1.11, including LRPD-02, Revision 1, Section 4.10, "Environmental Qualification (EQ) of Electrical Components Program," which provides an assessment of the AMP elements' consistency with GALL AMP X.E1. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B1.11 and associated bases documents to determine consistency with GALL AMP X.E1. Also, the project team reviewed LRPD-03, "TLAA and Exemption Evaluation," Volume 2.

During the audit and review, the project team noted that the results of electrical equipment in LRA Section 4.4 indicate that the aging effects of the EQ electrical equipment identified as TLAA will be managed during the extended period of operation under 10 CFR 54.21(c)(1)(iii). However, no information is provided on the attribute of a reanalysis of aging evaluation to extend the qualification life of electrical equipment identified as a TLAA. The important attributes of a reanalysis are the analytical methods, the data collection, the reduction methods, the underlying assumptions, the acceptance criteria, and corrective actions. The project team requested the applicant to provide information on these important attributes of re-analysis of an aging evaluation of electrical equipment identified in the TLAA to extend the qualification under 10 CFR 50.49(e). In response to the project team's request, **in a letter dated.....**, the applicant responded that LRA Appendix B.1.11 will be revised to add the following:

> PNPS may perform reanalysis of an aging evaluation of electrical components under 10 CFR 50.49(e) on a routine basis as part of the plant's EQ program. As described in NUREG-1801, Rev. 1, important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions.
>
> EQ Component Reanalysis Attributes:
>
> The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of an EQ program. While a component life-limiting condition may be due to thermal, radiation, or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized).

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The reanalysis of an aging evaluation is documented according to the station's quality assurance program requirements, which requires the verification of assumptions and conclusions. As already noted, important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed below.

Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those applied during the prior evaluation. The Arrhenius methodology is an acceptable model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (i.e., normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, one acceptable method of establishing the 60-year normal radiation dose is to multiply the 40-year normal radiation dose by 1.5 (i.e., 60 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For cyclical aging, a similar approach may be used. Other methods may be justified on a case-by-case basis.

Data Collection and Reduction Methods: Reducing excess conservatism in the component service conditions (e.g., temperature, radiation, cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Temperature data used in an aging evaluation are to be conservative and based on plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for technical specification compliance, other installed monitors, measurement made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurement are conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation, or (b) using the plant temperature data to demonstrate conservatism when using plant design temperature for an evaluation. Any changes to material activation energy values as part of a reanalysis are to be justified on a plant-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluation can be used for radiation and cyclical aging.

Underlying Assumption: EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions.

Acceptance Criteria and Corrective Actions: The reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component is to be refurbished, replaced, or re-qualified prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (i.e., sufficient time is available to refurbish, replace, or re-qualify the component is the reanalysis is unsuccessful).

The project team found the applicant's response acceptable because with a LRA supplement as described above, a reanalysis program, which meets the conditions defined in the GALL report for important attributes, is an acceptable AMP for license renewal under option 10 CFR 54.21(c)(1)(iii).

GALL AMP X.E1 under preventive actions states that 10 CFR 50.49 does not require actions that prevent aging effects. EQ program actions that could be viewed as preventive actions include (a) establishing the component service condition tolerance and aging limits (e.g., qualified life or condition limit) and (b) where applicable, requiring specific installation, inspection, monitoring, or periodic maintenance actions to maintain component aging effects within the bounds of the qualification basis. PNPS LRPD-02 Section 4.10 under same attribute did not provide EQ program actions that could be viewed as preventive actions. The project team requested the applicant to provide a description of preventive actions for the PNPS EQ program. In a letter dated.... (ML...), the applicant responded that 10 CFR 50.49 does not require actions that prevent aging effects. However, LRPD-02 will be revised to read as follows:

> The programactions that could be viewed as preventive actions are the identification of qualified life and specific maintenance/installation requirements.

The project team found the applicant's response acceptable because the applicant described the actions in PNPS EQ program that could be viewed preventive actions. These actions are similar to the actions described in the GALL Report.



The project team reviewed those portions of the applicant's EQ program for which the applicant claims consistency with GALL AMP X.E1 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's EQ program provided reasonable assurance that the aging effects of thermal, radiation, and cyclical for electrical equipment, important to safety, and located in harsh environments will be managed. The project team found the applicant's EQ program acceptable because it conforms to the recommended GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

3.0.3.1.3.3 <u>Exceptions to the GALL Report</u>

None.

3.0.3.1.3.4 <u>Enhancements</u>

None.

3.0.3.1.3.5 <u>Operating Experience</u>

The applicant stated, in the PNPS LRA, that the overall effectiveness of the EQ program is demonstrated by the excellent operating experience for systems, structures, and components in the program. The program has been subject to periodic internal and external assessments that have resulted in program improvement.

The team reviewed the EQ Program Self Assessment (January 28, 2002, to February 01, 2002). The assessment identified EQ files that had not been updated at the time of the assessment. The EQ files needed to be updated due to the implementation of a plant design change 01-03, Cycle 14 Reload Design. The impact of the reload design on the EQ program was evaluated in EQ document file Reference 420D and 420E prior to Refueling Outage 13. All EQ components were identified to remain qualified for the Cycle 14 reload design. As a result of the EQ Program Assessment Program, LO-PNPLO-2002-0011 CA-09 was initiated to track and enforce work down of remaining EQ document file's per established work down curves. This LO action was closed on October 7, 2002.

The project team also 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 and discussions with the applicant's technical staff, the project team concluded that the applicant's EQ program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.3.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the EQ program in PNPS LRA, Appendix A, Section A.2.1.11, which states that the program manages the effects of thermal, radiation, and cyclic 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 refurbished, replaced, or their qualification is extended prior to reaching the aging limits established in the evaluations. Aging evaluations for EQ components are considered time-limited aging analyses (TLAAs) for license renewal.

The project team reviewed the UFSAR Supplement PNPS AMP B1.11, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.3.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 FLOW-ACCELERATED CORROSION PROGRAM (PNPS AMP B.1.14)

In PNPS LRA, Appendix B, Section B1.14, the applicant stated that PNPS AMP B1.14, "Flow-Accelerated Corrosion Program," is an existing plant program that is consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion."

3.0.3.1.4.1 Program Description

The applicant stated, in the PNPS LRA, that this program applies to safety-related and nonsafety-related carbon steel components in systems containing high-energy fluids carrying two-phase or single-phase high-energy fluid, with greater or equal to 2 percent of plant operating time. The program, based on EPRI Report NSAC-202L-R2 recommendations for an effective flow-accelerated corrosion (FAC) program, predicts, detects, and monitors FAC in plant piping and other pressure-retaining components. This program includes (a) an evaluation to determine critical locations, (b) initial operational inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm predictions, or repair, or replace components, as necessary.

3.0.3.1.4.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B1.14 is consistent with GALL AMP XI.M17.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 6 of this audit and review report for PNPS AMP B1.14, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.13, "Flow-Accelerated Corrosion Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M17. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B1.14 and associated bases documents to determine consistency with GALL AMP XI.M17.

During the audit and review, the project team asked the applicant about the piping systems that are excluded from the FAC program scoping as a result of low operating time (i.e., less than 2 percent of plant operating time). Also, the project team inquired about the inspections that were performed to ensure there was no wear on those lines. The low operating time exclusion was not specifically mentioned in the GALL Report. The applicant responded that:

> Portions of the Main Steam system (i.e., Plant Heating, Reactor Vessel Vent Lines, Portions of the Feedwater System [recirculation lines to the condenser-feedwater clean-up line to the condenser], Feedwater Heater Start-up Vent Lines, Portions of RCIC, and Portions of HPCI) have been excluded. Inspections have been performed on some of these lines typically in response to operational issues such as valve leakage or orifice degradation occurring such that there is flow in the line during normal operation.
>
> In RFO14 and RFO15, the feedwater recycle line (FAC pt# 366) was inspected to verify that a leaking valve had not caused damage. The piping wall thickness was found to not have appreciably changed during the two inspections which provided evidence that significant

wear of the piping had not and was not occurring. In RFO15, the RCIC minimum flow bypass line (FAC pt# 376) was inspected due to suspected valve leak, and the downstream piping was found to show no significant wear based on wall thickness. (Reference???)

The project team determined that this response is acceptable because adequate inspections have been performed, which is consistent with the guidance provided in Section 4.2.2, "Exclusion of System From Evaluation" of EPRI Report NSAC-202L-R2. The GALL AMP XI.M17 program is also based on the recommendations provided in EPRI Report NSAC-202L-R2.

The project team reviewed those portions of the applicant's Flow-Accelerated Corrosion Program for which the applicant claims consistency with GALL AMP XI.M17 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Flow-Accelerated Corrosion Program provided reasonable assurance that the program will adequately manage plant aging for the period of extended operation. The project team found the applicant's Flow-Accelerated Corrosion Program acceptable because it conforms to the recommended GALL AMP XI.M17, "Flow-Accelerated Corrosion."

3.0.3.1.4.3 Exceptions to the GALL Report

None.



3.0.3.1.4.4 Enhancements

None.

3.0.3.1.4.5 Operating Experience

The applicant stated, in the PNPS LRA, that 65 FAC UT examinations were performed on-line (between RFO13 and RFO14) and during RFO14 (April 2003). The examinations included components in the condensate, extraction steam, feedwater, heater vents and drains, main steam, reactor core isolation cooling, and reactor water cleanup systems. Five of the examinations detected decreased wall thickness. Two of the components were accepted after re-evaluation and the other three components were replaced. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing loss of material in carbon steel components.

Ninety-seven FAC UT examinations were performed on-line (between RFO14 and RFO15) and during RFO15 (April 2005). The examinations included components in the condensate, extraction steam, feedwater, heater vents and drains, main steam, reactor core isolation cooling, and reactor water cleanup systems. Three of the examinations detected decreased wall thickness. Two of the components were accepted after re-evaluation and the other component was repaired. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing loss of material in carbon steel components.

During RFO15 (April 2005), five piping upgrades to FAC resistant material (ASTM A335 GR P11) were performed. The FAC program document was developed with input from each of the Entergy Nuclear Northeast (ENN) FAC engineers as a standardized ENN procedure. Therefore, it includes improvements based on industry and other ENN plant operating experience. For example, skid-mounted piping is now included in the enhanced system susceptibility evaluation. During RFO15, several FAC points were added to inspections, or re-inspected, in response to industry operating experience and the event that occurred at MIHAMA Japan.

A self-assessment in January 2005 revealed no issues or findings that could impact effectiveness of the program to manage FAC in carbon steel components in systems containing high-energy fluids greater or equal to two percent of plant operating time.

The project team also reviewed the operating experience provided in the basis document 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 concluded that the applicant's Flow-Accelerated Corrosion Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.4.6 <u>UFSAR Supplement</u>



The applicant provided its UFSAR Supplement for the Flow-Accelerated Corrosion Program in PNPS LRA, Appendix A, Section A.2.1.15, which states that the Flow-Accelerated Corrosion Program applies to safety-related and non-safety-related carbon steel components in systems containing high-energy fluids carrying two-phase or single-phase high-energy fluid, with greater or equal to 2 percent of plant operating time.

The program, based on EPRI recommendations for an effective flow-accelerated corrosion program, predicts, detects, and monitors FAC in plant piping and other pressure-retaining components. This program includes (a) an evaluation to determine critical locations, (b) initial operational inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm predictions. The program specifies repair or replacement of components as necessary.

The project team reviewed the UFSAR Supplement PNPS AMP B1.14, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.4.7 <u>Conclusion</u>

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 NON-EQ INACCESSIBLE MEDIUM-VOLTAGE CABLE PROGRAM (PNPS AMP B.1.19)

In PNPS LRA, Appendix B, Section B.1.19, the applicant stated that PNPS AMP B.1.19, "Non-EQ Inaccessible Medium-Voltage Cable Program," is a new plant program that will be consistent with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

3.0.3.1.5.1 Program Description

The applicant stated, in the PNPS LRA, that periodic actions will be taken in the program to prevent cables from being exposed to significant moisture, such as inspecting for water collectio n in cable manholes and conduit, and draining water, as needed. In scope medium-voltage cables exposed to significant moisture and voltage will be 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.

The program will be initiated prior to the period of extended operation.

3.0.3.1.5.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.19 is consistent with 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 audit and review report for PNPS AMP B.1.19, including LRPD-02, Rev. 1, Section 3.4 "Non-EQ Inaccessible Medium-Voltage Cable Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.E3. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.19 and associated bases documents to determine consistency with GALL AMP XI.E3.

The project team also reviewed AMRE-01, Rev. 2, "Electrical Screening and Aging Management Reviews."

During the audit and review, the project team noted that GALL XI.E3 under detection of aging effects recommended that the inspection for water collection should be performed based on actual plant experience with water accumulation in the manholes. However, the inspection frequency should be at least once every two years. The PNPS Non-EQ Inaccessible Medium-Voltage Cable Program, under the same attribute, states that inspection for water collection in cable manholes and conduit occur at least once every two years. The team requested the applicant to explain how operating experience is considered in manhole inspection frequency. In response to the team request, the applicant **in a letter dated.... ..(ML....)**, responded that LRPD-02 will be revised to include the following:

> The inspection will be based on actual plant experience with water accumulation in the manholes and the frequency of inspection will be adjusted based on the results of the evaluation, but the frequency will be at least once every two years.

The team found the applicant's response acceptable because the criteria for inspection for water collection in the manholes will be based on actual plant experience with water accumulation. These criteria are consistent with the GALL Report.

Under the Scope of Program, GALL XI.E3 defines significant moisture as periodic exposure to moisture that lasts less than few days (e.g., cable in standing water). Significant voltage exposure is defined as being subject to system voltage for more than 25 percent of the time. PNPS LRPD-02, Rev. 1, under same attribute, states that this program will include inaccessible (i.e., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with applied voltage. However, PNPS LRPD-02, Rev. 1 does not specifically define the significant voltage and moisture. In addition, AMRE-01, Rev. 2, Section 3.4.1.5, "Non-EQ Inaccessible Medium-Voltage Cable Screening" states that cables susceptible to water treeing are cables which are exposed to significant moisture (submerged for years). The project team requested the applicant to either (1) revise the AMP B.1.19 basis document to ensure consistency with the GALL Report's scope or (2) explain how inaccessible medium-voltage cables exposed to significant moisture for more than few days and less than a few years are not susceptible to water treeing. **In a letter dated... (ML....)**, the applicant responded that it would revise the LRPD as follows:

> This program applies to inaccessible (e.g., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with significant voltage. Significant moisture is defined as periodic exposure to moisture that lasts more than a few days (e.g., cable in standing water). Periodic exposure to moisture that lasts less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than 25 percent of the time.

The team found the applicant's response acceptable because the Scope of Program is consistent with the GALL Report.

Under the program description, the GALL Report states that periodic actions, such as inspecting for water collection in cable manholes and draining water as needed to prevent cable from being exposed to significant moisture, are not sufficient to assure water is not trapped elsewhere in raceways. In addition to the above periodic actions, in-scope medium-voltage cables are tested to provide an indication of the condition of the conductor insulation. PNPS LRPD, under the same attribute, stated that periodic actions will be taken to prevent cables from being exposed to significant moisture. These actions include inspecting for water collection in cable manholes and conduits, and draining water as needed. In-scope medium-voltage cables exposed to significant moisture and voltage will be tested to provide an indication of the conductor insulation. The project team requested the applicant to confirm that the intent of the AMP is to (1) inspect for water in manholes and (2) test all in-scope medium-voltage cables. In response to the team's request, **the applicant stated in a letter dated....(ML.....)** that the PNPS intends to inspect for water in manholes and to test the in-scope medium-voltage cables.

GALL XI.E3 defines medium-voltage cable as cable rated for 2 kV to 35 kV. AMRE-01, Rev. 2, "Aging Management Review Report Electrical," lists medium voltage cables from 2 kV to 23 kV. The project team requested the applicant to define medium-voltage cable in the LRA as consistent with the GALL Report or to provide a justification of why water treeing (the effects of significant moisture to energized medium-voltage cables) is not applicable to inaccessible medium-voltage cable greater than 23 kV. In response to the team's request, **in a letter dated... (ML.....)**, the applicant responded that LRA Appendix B.1.19 defines medium-voltage cables as follows:

> For this program, medium voltage cables are from 2 kV to 35 kV.

The team found the applicant's response acceptable because it is consistent with the GALL Report's Scope of Program.

Under parameters monitored/inspected, the GALL Report states that the specific type of test performed will be determined prior to the initial test. This will be a proven test for detecting deterioration of the insulation system due to wetting such as power factor, partial discharge test, or polarization index (as described in EPRI TR-103834-P1)or other testing that is state-of-the-art at the time the test is performed. PNPS LRPD under the same attribute only stated that the specific type of test performed will be determined prior to the initial test. The project team requested that the applicant revise the LRPD to be consistent with the GALL Report or explain how it would ensure that the test is performed in accordance with industrial guidelines. In a letter dated....(ML....), the applicant responded that the specific type of test to be performed will be determined prior to the initial test, and it will be a proven test for detecting deterioration of the insulation system due to wetting as described in EPRI TR-103834-P1-2,or other testing that is state-of-the-art at the time the test is performed. The project team found the applicant's response acceptable because the test to be performed will be in accordance with industry guidelines.

The electrical screening and aging management review (AMRE-01) provides a list of in-scope inaccessible medium-voltage cables. However, the review does not include the service water cables. The project team requested that the applicant explain why these cables are not in-scope of the non-EQ inaccessible medium-voltage cable AMP. In a letter dated.. **(ML....)**, the applicant responded that since medium-voltage cables are defined as 2 kV to 35 kV, the service water cables are not in scope because they run on a system voltage of 480 V. The project team found the applicant's response acceptable because the system voltage of 480 V is not considered medium-voltage and therefore, the service water cables are not in-scope of the non-EQ inaccessible medium-voltage AMP.

The project team reviewed those portions of the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program for which the applicant claims consistency with GALL AMP XI.E3 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program at PNPS will be comparable to the program described in NUREG-1801, Section XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." In this program, periodic actions will be taken to prevent cables from being exposed to significant moisture (such as inspecting for water collection in cable manholes and conduits, and draining water as needed). In addition, in-scope medium-voltage cables exposed to significant moisture and voltage will be 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 will be performed in accordance with industry guidelines.

The program will be initiated prior to the period of extended operation. The Non-EQ Inaccessible Medium-Voltage Cable Program provided reasonable assurance that the aging effects of inaccessible medium-voltage cables due to significant moisture and voltage will be managed and that the in-scope components will continue to perform their intended function for the period of extended operation. The project team found the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program acceptable because it conforms to the recommended GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."



3.0.3.1.5.3 Exceptions to the GALL Report

None.

3.0.3.1.5.4 Enhancements

None.

3.0.3.1.5.5 Operating Experience

In the LRA, the applicant stated that the Non-EQ Inaccessible Medium-Voltage Cable Program at PNPS is a new program for which there is no operating experience. GALL XI.E3 indicates that operating experience has shown that degradation of cables and connections within the scope of XI.E3 may exist. The project team requested that the applicant provide industrial and plant-operating experience for this program. **In a letter dated.... (ML.....), the applicant responded that....**

The project team also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

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 concluded that the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.5.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Non-EQ Inaccessible Medium-Voltage Cable Program in PNPS LRA, Appendix A, Section A.2.1.21, which states that in scope medium-voltage cables, not designed for, but exposed to significant moisture and voltage are tested at least once every 10 years to provide an indication of the condition of the conductor insulation. The specific test performed is a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed. Significant moisture is defined as periodic exposures that last more than a few days. Significant voltage exposure is defined as being subjected to system voltage for more than 25 percent of the time.

Inspections for water collection in cable manholes and conduit occur at least once every two years.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.19, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).



3.0.3.1.5.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 NON-EQ INSTRUMENTATION CIRCUITS TEST REVIEW PROGRAM (PNPS AMP B.1.20)

In PNPS LRA, Appendix B, Section B.1.20, the applicant stated that PNPS AMP B.1.20, "Non-EQ Instrumentation Circuits Test Review Program," is a new plant program that is consistent with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits."

3.0.3.1.6.1 Program Description

The applicant stated, in the PNPS LRA, that this program will provide reasonable assurance that the intended functions of instrument cables exposed to adverse localized equipment environments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is significantly more severe than the specified service environment for the cable. This program will consider the technical information and guidance provided in NUREG/CR-5643 IEEE Std. P1205, SAND96-0344, and EPRI TR-109619.

The program will be initiated prior to the period of extended operation.

3.0.3.1.6 2 <u>Consistency with the GALL Report</u>

In PNPS LRA, the applicant stated that PNPS AMP B.1.20 is consistent with GALL AMP XI.E2.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.20, including LRPD-02, Section 3.5, "Non-EQ Instrumentation Circuits Test Review Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.E2. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.20 and associated bases documents to determine consistency with GALL AMP XI.E2.



The project team also reviewed AMRE-01, Rev. 2, "Electrical Screening and Aging Management Reviews."

During the audit and review, the project team noted that GALL XI.E2 recommends that the test frequency shall be determined by the applicant based on engineering evaluation, but the test frequency shall be at least once every 10 years. PNPS LRPD-02, Section 3.5, under the same attribute, states that for neutron flux monitoring system cables that are disconnected during instrument calibration, testing is performed at least once every10 years. The project team requested that the applicant explain how engineering evaluation is considered in the test frequency. **In a letter dated... (ML....)**, the applicant responded that to clarify the PNPS AMP's consistency with the GALL Report's recommendation, LRPD-02 will be revised as follows:

> The first test of neutron-monitoring system cables that are disconnected during instrument calibrations shall be completed before the period of extended operation, and subsequent tests will occur at least every 10 years. In accordance with the Corrective Action Program, an engineering evaluation will be performed when test acceptance criteria are not met and corrective actions, including modified inspection frequency, will be implemented to ensure that the intended functions of the cables can be maintained consistent with the current license basis (CLB) for the period of extended operation.

The project team found the applicant's response acceptable because testing frequency will be at least once every 10 years and modified testing frequency based on an engineering evaluation will be implemented when acceptance criteria are not met to ensure intended functions of the cables can be maintained consistent with the CLB. This action is consistent with the intent of

GALL AMP XI.E2 in regard to testing frequency.

The scope of GALL AMP XI.E2 applies to cable system (cables and connections). The project team requested that the applicant confirms the test includes both cables and connections. In a letter dated.... (ML....), the applicant confirmed that the Non-EQ Instrumentation Circuits Test Review Program includes both cables and connections that are in scope of license renewal.

Under Scope of Program, GALL AMP XI.E2 states that this program applies to cable systems used in circuits with sensitive, high-voltage, low-level signals such as radiation monitoring and nuclear instrumentation that are subject to an AMR. PNPS LRPD-02, Section 3.5, under the same attribute, states that this program will include non-EQ electrical cables used in circuits with sensitive, high-voltage, low-level signal (i.e., neutron flux monitoring instrumentation). The program did not include high-range radiation monitor cables. The project team requested that the applicant explain why high-range radiation monitor cables are not in the scope of the non-EQ instrumentation circuits test review program. In a letter dated... (ML....), the applicant responded that the high-range radiation monitoring system monitors radiation levels inside containment (drywell and torus areas) during and following a design basis event. The monitors (RE 1001-606A/B and RE 1001-607A/B) are safety related. The cables from the detectors to the cabinets in the control room are EQ and, therefore, are replaced based on qualified life. For this reason, these cables are not subject to an AMR. The project team found the applicant response acceptable because the high-range radiation monitoring cables are EQ, they are not in-scope of the non-EQ instrumentation circuits test review program.

The project team reviewed those portions of the applicant's Non-EQ Instrumentation Circuits Test Review Program for which the applicant claims consistency with GALL AMP XI.E2 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Non-EQ Instrumentation Circuits Test Review Program provided reasonable assurance that instrument cables exposed to adverse localized equipments caused by heat, radiation, and moisture can be maintained consistent with the current licensing basis through the period of extended operation. The project team found the applicant's Non-EQ Instrumentation Circuits Test Review Program acceptable because it conforms to the recommended GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits."

3.0.3.1.6 3 Exceptions to the GALL Report

None.

3.0.3.1.6 4 Enhancements

None.

3.0.3.1.6.5 Operating Experience

The applicant stated, in the PNPS LRA, that the Non-EQ Instrumentation Circuits Test Review

Program at PNPS is a new program for which there is no operating experience. Industry and plant-specific operating experience will be considered in the development of this program, and future operating experience will be appropriately incorporated into the program.

GALL AMP XI.E2 indicates that operating experience has shown that degradation of cables and connections within the scope of XI.E2 may exist. The project team requested the applicant to provide industrial and plant operating experience for this program. **In a letter dated.... (ML....), the applicant stated that.....**

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

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 concluded that the applicant's Non-EQ Instrumentation Circuits Test Review Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.6.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Non-EQ Instrumentation Circuits Test Review Program in PNPS LRA, Appendix A, Section A.2.1.22, which states that the program calibration or surveillance results for non-EQ electrical cables in circuits with sensitive, high voltage, low-level signals; (i.e., neutron flux monitoring instrumentation); are reviewed. Most neutron flux monitoring system cables and connections are calibrated as part of the instrumentation loop calibration at the normal calibration frequency, which provides sufficient indication of the need for corrective actions based on acceptance criteria related to instrumentation loop performance. The review of calibration results is performed once every 10 years.

For neutron flux monitoring system cables that are disconnected during instrument calibrations, testing is performed at least once every 10 years using a proven method for detecting deterioration for the insulation system (such as insulation resistance tests or time domain reflectometry).

The project team reviewed the UFSAR Supplement PNPS AMP B.1.20, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.6.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

#### 3.0.3.1.7 NON-EQ INSULATED CABLES AND CONNECTIONS PROGRAM (PNPS AMP B.1.21)

In PNPS LRA, Appendix B, Section B.1.21, the applicant stated that PNPS AMP B.1.21, "Non-EQ Insulated Cables and Connections Program," is an existing plant program that is consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

##### 3.0.3.1.7.1 Program Description

The applicant stated, in the PNPS LRA, that this program will provide reasonable assurance that intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation, and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is significantly more severe than the specified service condition for the insulated cables or connections.



A representative sample of accessible insulated cables and connections within the scope of license renewal will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. The technical basis for sampling will be determined using EPRI document TR-109619, "Guideline for the Management of Adverse Localized Equipment Environments."

The program will be initiated prior to the period of extended operation.

##### 3.0.3.1.7.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.21 is consistent with 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 audit and review report PNPS AMP B.1.21, including LRPD-02, Revision 1, Section 3.6, "Non-EQ Insulated Cables and Connections Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.E1. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.21 and associated bases documents to determine consistency with GALL AMP XI.E1.

Also, the project team reviewed AMRE-01, Rev. 2, "Electrical Screening and Aging Management Reviews."

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During the audit and review, the project team noted that GALL XI.E1 under program description states that the program described herein is written specifically to address cables and connections at plants whose configuration is such that most (if not all) cables and connections installed in adverse localized environments are accessible. This program, as described, can be thought of as a sampling program. Selected cables and connections from accessible areas (the inspection sample) are inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. If an unacceptable condition or situation is identified for a cable or connection in the inspection sample, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connection. In PNPS AMP B.1.21, under the same element, it states that a representative sample of accessible insulated cables and connections, within the scope fo license renewal, will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking, or surface contamination. The project team requested the applicant to explain the technical basis for cable sampling. In response to the team's request, **In a letter dated.....(ML..)**, the applicant states that the LRA Appendix B.1.19 program description will be changed to read as follows:

> This program addresses cables and connections at plants whose configuration is such that most cables and connections installed in adverse localized environments are accessible. This program can be thought of as a sampling program. Selected cables and connections from accessible areas will be inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. If an unacceptable condition or situation is identified for a cable or connection in the inspecting sample, a determination will be made as to whether the same condition or situation is applicable to other accessible cables or connections. The sample size will be increased on an evaluation per EN-LI-102-Corrective Action Process.

The team found the applicant's response acceptable because it provided the technical bases for cable sampling; these bases are consistent with the GALL Report.

Under the Scope of Program, GALL XI.E1 states that the inspection program applies to accessible electrical cables and connections within the scope of license renewal that are installed in adverse localized environments caused by heat or radiation in the presence of oxygen. PNPS LRPD-02, Section 3.6, under the same element, states that this program will include accessible insulated cables and connections installed in structures within the scope of license renewal and prone to adverse localized environments. The project team requested the applicant to explain what "in a structure" meant and why structures were included in the scope of non-EQ cables and connections AMP. **In a letter dated.....(ML...)**, the applicant stated that "in a structure" means inside the plant and not outside. The LRPD-02 will be revised to state that the program applies to accessible electrical cables and connections within the scope of license renewal that are installed in adverse localized environments caused by heat or radiation in the presence of oxygen. The project team found the applicant's response acceptable because, with removal of the phase "in a structure," the scope of AMP B.1.21 is consistent with the scope of GALL XI.E1.

The project team reviewed those portions of the applicant's Non-EQ Insulated Cables and Connections Program for which the applicant claims consistency with GALL AMP XI.E1 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Non-EQ Insulated Cables and Connections Program provided reasonable assurance that aging effects of cables and connectors within the scope of license renewal exposed to adverse localized environments due to temperature, moisture, or radiation with the presence of oxygen will be managed to be consistent with CLB during extended period of operation. The project team found the applicant's Non-EQ Insulated Cables and Connections Program acceptable because it conforms to the recommended GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualifications Requirements."

3.0.3.1.7.3 Exceptions to the GALL Report

None.

3.0.3.1.7.4 Enhancements

None.

3.0.3.1.7.5 Operating Experience



The applicant stated, in the PNPS LRA, that the Non-EQ Insulated Cables and Connections Program at PNPS is a new program for which there is no operating experience.

GALL AMP XI.E1 indicated that operating experience had shown that degradation of cables and connection within the scope of XI.E1 may exist. The project team requested that the applicant provide industrial and plant-operating experience for this program. **In a letter dated.... (ML....),** the applicant responded that....

Operating experience at PNPS is controlled by procedure EN-OP-100, "Operating Experience Program." The program includes the following components:

- Operating experience — information received from various industry sources that describes events, issues, and equipment failures that may represent opportunities to apply lessons learned to avoid negative consequences or to recreate positive experience as applicable.

- Internal operating experience — operating experience (OE) that originates as a condition report or request from plant personnel which warrants consideration for possible Entergy-wide distribution. Internal OE can originate from any Entergy plant or headquarters.

- Impact evaluation — analysis of an OE event or problem that requires additional information and research to determine impact or potential impact as it relates to plant condition and/or configuration. Impact evaluations are typically documented with a condition report. Condition report action items and corrective actions are used to confirm program effectiveness and to modify the program as needed.

The project team recognized that the corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

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 concluded that the applicant's Non-EQ Insulated Cables and Connections Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.7.6 <u>UFSAR Supplement</u>

The applicant provided its UFSAR Supplement for the Non-EQ Insulated Cables and Connections Program in PNPS LRA, Appendix A, Section A.2.1.23, which states that the Non-EQ Insulated Cables and Connections Program provides reasonable assurance that intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is significantly more severe than the specified service condition for the insulated cable or connection.



A representative sample of accessible insulated cables and connections in adverse localized environments is visually inspected at least once every 10 years for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.21, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.7.7 <u>Conclusion</u>

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 <u>ONE-TIME INSPECTION PROGRAM (PNPS AMP B.1.32)</u>

In PNPS LRA, Appendix B, Section B.1.32, the applicant stated that PNPS AMP B.1.32, "One-Time Inspection Program," is an existing plant program that is consistent with GALL AMP XI.M32, "One-Time Inspection."

3.0.3.1.8.1 <u>Program Description</u>

The applicant stated, in the PNPS LRA, that this program is a new program that will be implemented prior to the period of extended operation. The program will be comparable to the program described in NUREG-1801, Section XI.M32, One-Time Inspection. The one-time inspection activity for small bore piping in the reactor coolant system and associated systems that form the reactor coolant pressure boundary, will also be comparable to the program described in NUREG-1801, Section XI.M35, One-Time Inspection of American Society of Mechanical Engineers (ASME) Code Class I Small-Bore Piping. The PNPS program will be consistent with the program elements described in NUREG-1801.

The program will include one activity to verify effectiveness of an aging management program and activities to confirm the absence of aging effects as described below.

| | |
|---|---|
| Water chemistry control programs | One-time inspection activity will verify the effectiveness of the water chemistry control aging management programs by confirming that unacceptable cracking, loss of material, and fouling is not occurring. |
| Internal surfaces of buried carbon steel pipe on the standby gas treatment system discharge to the stack. | One-time inspection activity will confirm that loss of material is not occurring or is so insignificant that an aging management program is not warranted. |
| Internal surfaces of compressed air and emergency diesel generator system components containing untreated air. | One-time inspection activity will confirm that cracking (EDG system) and loss of material (compressed air and EDG systems) are not occurring or are so insignificant that an aging management program is not warranted. |
| Internal surfaces of stainless steel radioactive waste and sanitary soiled waste and vent system components containing untreated water. | One-time inspection activity will confirm that loss of material is not occurring or is so insignificant that an aging management program is not warranted. |
| Small bore piping in the reactor coolant system and associated systems that form the reactor coolant pressure boundary. | One-time inspection activity will confirm that cracking and reduction of fracture toughness are not occurring or are so insignificant that an aging management program is not warranted. |
| RV flange leakoff line. | One-time inspection activity will confirm that cracking is not occurring or is so insignificant that an aging management program is not warranted. |

| | |
|---|---|
| Main steam flow restrictors (CASS). | One-time inspection activity will confirm that loss of material, cracking, and reduction of fracture toughness are not occurring or are so insignificant that an aging management program is not warranted. |

The elements of the program 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.

When evidence of an aging effect is revealed by a one-time inspection, routine evaluation of the inspection results will identify appropriate corrective actions.

The inspection will be performed within the 10 years prior to the period of extended operation.

3.0.3.1.8.2 Consistency with the GALL Report



In PNPS LRA, the applicant stated that PNPS AMP B.1.23 is consistent with GALL AMP XI.M32. The applicant stated that this program is also consistent with GALL AMP XI.M35.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report PNPS AMP B.1.23, including Aging Management Program Evaluation Report (AMPER), LRPD-02, Revision 1, Section 3.7, "One-Time Inspection Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M32 and GALL AMP XI.M35. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.23 and associated bases documents to determine consistency with GALL AMP XI.M32 and GALL AMP XI.M35.

During the audit and review, the project team asked the applicant to provide a list of systems in element of "Scope of Activity," where one-time inspection was performed. In its response, the applicant stated that as described in LRA Section B.1.23, the One-Time Inspection Program includes several activities. The activities to confirm the absence of aging effects identify the systems to which they apply. For instance, the activity for inspection of "internal surfaces of buried carbon steel pipe on the standby gas treatment system discharge to the stack" inspects components in the gas treatment system. The activities to verify effectiveness of the water chemistry control programs are applicable to many systems. The systems are not listed in LRA Section B.1.23. However, they may be found in tables in LRA Section 3.0, Aging Management Review Results. In these tables, systems with line items containing one of the water chemistry control programs have components included in the sample population for this one-time inspection activity. Based on a review of the AMPER and the associated AMPER for water chemistry control programs, the project team found the applicant response to be acceptable.

During the audit and review, the project team asked the applicant how the sample of small piping welds, 4" and smaller, will be picked for performing non-destructive examination (NDE) inspection. In its response, the applicant stated that as described in the Aging Management Program Evaluation Report identified above, the One-Time Inspection Program will carry out an inspection of small bore piping in the reactor coolant system and associated systems that form the reactor coolant pressure boundary. This activity will include the inspection of a statistically significant sample of welds of each material and environment combination in class 1 piping less than or equal to 4" nominal pipe size (NPS). The initial population will include all class 1 small bore piping, and actual locations will be selected based on physical location, exposure levels, NDE techniques and locations identified in NRC IN 97-46, Un-isolable Crack in High-Pressure Injection piping. The project team further asked the applicant to clarify that volumetric examinations are used to detect cracking in butt welds. In its response, the applicant stated that the AMPER, LRPD -02, page 268, detection of aging effects will be revised to state, "Combinations of non-destructive examinations (including VT-1, enhanced VT-1, ultrasonic, and surface techniques) will be performed by qualified personnel following procedures that are consistent with Section XI of ASME Code and 10CFR50, Appendix B. Volumetric examinations are used to detect cracking in butt welds. Actual inspection locations will be based on physical accessibility, exposure levels, NDE techniques and locations identified in NRC IN 97-46, Un-isolable Crack in High-Pressure Injection piping." Based on the above, the project team found the response acceptable. **(Open Item, review LRPD-02 change at next site audit)**

During the audit and review, the project team asked the applicant how it will handle the aging of small piping socket welds. In its response, the applicant stated that during the 4th inservice inspection (ISI) interval, PNPS plans to perform both VT-2 and PT examinations, at a minimum, of socket welds in accordance with the PNPS 4th interval ISI Program Plan. The one-time inspection of small bore piping does not exclude locations based upon geometry. Therefore, class 1 small-bore piping socket welds will be selected for one-time inspection based upon physical location and exposure levels. Since small-bore piping socket will be inspected at least once, the project team found the applicant response acceptable.

The project team reviewed those portions of the applicant's One-Time Inspection Program for which the applicant claims consistency with GALL AMP XI.M32 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's One-Time Inspection Program provided reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's One-Time Inspection Program acceptable because it conforms to the recommended GALL AMP XI.M32, "One-Time Inspection," and GALL AMP XI.M35, "One-Time Inspection of ASME Code Class Small-Bore Piping."

3.0.3.1.8.3 Exceptions to the GALL Report

None.

3.0.3.1.8.4 Enhancements

None.

3.0.3.1.8.5 Operating Experience

The applicant stated, in the PNPS LRA, that the One-Time Inspection Program is a new program for which there is no operating experience. Industry and plant-specific operating experience will be considered in development of this program, as appropriate.

Since this is a new program, the project team reviewed Operating Experience Review Report, LRPD-05, Revision 0, in general to determine if it included any small pipe issues. This report provides information from condition reports (CRs) and programowner interviews, and covers a period of the last five years. The project team determined that the applicant has a good corrective action program that identifies issues and age-related degradation in a timely manner.

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 concluded that the applicant's One-Time Inspection Programwill adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.8.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the One-Time Inspection Program in PNPS LRA, Appendix A, Section A.2.1.25, which states that the elements of the One-Time Inspection Program 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.

A one-time inspection activity is used to verify the effectiveness of the water chemistry control programs by confirming that unacceptable cracking, loss of material, and fouling is not occurring on components within systems covered by water chemistry control programs[LRA Sections A.2.1.36, A.2.1.37, and A.2.1.38].

The project team also reviewed the operating experience provided in the PNPS 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.

One-time inspection activities are used on the following components to confirm that loss of material, cracking, and reduction of fracture toughness, as applicable, are not occurring or are so insignificant that an aging management program is not warranted:

- Internal surfaces of buried carbon steel pipe on the standby gas treatment system discharge to the stack.

- Internal surfaces of compressed air and EDG system components containing untreated air.
- Internal surfaces of stainless steel radioactive waste and sanitary soiled waste and vent system components containing untreated water.
- Small bore piping in the reactor coolant system and associated systems that form the reactor coolant pressure boundary.
- Reactor vessel flange leak-off line.
- Main steam flow restrictors.

When evidence of an aging effect is revealed by a one-time inspection, routine evaluation of the inspection results will identify appropriate corrective actions.

During the audit and review, the project team noted that the applicant's description of the One-Time Inspection Program in the UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the implementation of the new program. The description in Appendix A did not indicate that this was a new program nor did it include a commitment to implement it. The applicant was asked to justify why Appendix A did not include a commitment for the new program. In response to this request, the applicant stated that program description in Appendix A would be revised to identify the commitment. The program description in Appendix A will be amended to include the following statement:

> License renewal commitment # X governs implementation of this program.

This will require an amendment to the license renewal application. **(Open Item).**

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.23, and the amendment above, and found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.8.7 <u>Conclusion</u>

On the basis of its audit and review of the applicant's One-Time Inspection program, the project team found 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 found 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 and amendment for this program, the project team found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 SELECTIVE LEACHING PROGRAM (PNPS AMP B.1.27)

In PNPS LRA, Appendix B, Section B.1.27, the applicant stated that PNPS AMP B.1.27, "Selective Leaching Program," is a new plant program that is consistent with GALL AMP XI.M33, "Selective Leaching of Materials."

3.0.3.1.9.1 Program Description

The applicant stated, in the PNPS LRA, that this program will ensure the integrity of components made of cast iron, bronze, brass, and other alloys exposed to raw water, treated water, or groundwater that may lead to selective leaching. The program will include a one-time visual inspection and hardness measurement of selected components that may be susceptible to selective leaching to 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 for the period of extended operation.

The program will be initiated prior to the period of extended operation.

3.0.3.1.9.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.27 will be consistent with GALL AMP XI.M33.



The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.27, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 3.8, "Selective Leaching Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M33. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.27 and associated bases documents to determine consistency with GALL AMP XI.M33.

The project team reviewed those portions of the applicant's Selective Leaching Program for which the applicant claims consistency with GALL AMP XI.M33 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Selective Leaching Program provided reasonable assurance that the selective leaching of materials will be adequately managed for the period of extended operation. The project team found the applicant's Selective Leaching Program acceptable because it conforms to the recommended GALL AMP XI.M33, "Selective Leaching of Materials."

3.0.3.1.9.3 Exceptions to the GALL Report

None.

3.0.3.1.9.4 Enhancements

None.

3.0.3.1.9.5 Operating Experience

The applicant stated, in the PNPS LRA, that the Selective Leaching Program is a new program for which there is no (program) operating experience. However, as noted in the GALL Report, industry operating experience has shown that the components made of cast iron, bronze, brass, and other alloys exposed to a raw water, brackish water, treated water, or ground-water environment may lead to selective leaching of one of the metal components.

During the audit and review, the project team asked PNPS for operating experience regarding circulating water pumps replacement due to selective leaching. The applicant provided information that it had replaced P-105A ("A" Circulating Sea Water Pump) in RFO#15 (April 2005) as a result of OE from the vendor (Flowserve) informing PNPS that a failure of a cast iron circulating water pump occurred at the New Boston Fossil Station in 2004 due to graphitization. That pump was a similar design to PNPS with six additional years of submergence/operation in salt water. Six core samples of the pump casing were sent out to a materials lab for analysis, and the results confirmed graphitization. Currently, PNPS plans to replace P-105B in RFO #17 based on the core sample analysis obtained from P-105A columns. PNPS has also purchased, and has onsite the columns for P105B overhaul/replacement. The new pump columns are cast iron enhanced with the addition of 3 to 5 percent Nickel to improve strength and resistance to graphitization. The original columns were ASTM A48 CL 35 with 1.75 to 2.25 percent Nickel.

The project team recognized that the Corrective Action Program, which captures internal and external plant operating experience issues, as noted in the above example, 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.

The project team also reviewed the operating experience provided in the basis document 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 concluded that the applicant's Selective Leaching Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.9.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Selective Leaching Program in PNPS LRA, Appendix A, Section A.2.1.29, which states that the Selective Leaching Program ensures the integrity of components made of cast iron, bronze, brass, and other alloys exposed to raw water, treated water, or groundwater that may lead to selective leaching. The program includes a one-time visual inspection and hardness measurement of selected components that may be susceptible to selective leaching to 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 for the period of extended operation.

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The project team also reviewed the applicant's license renewal commitment list in Appendix A of the PNPS LRA and confirmed that this program is identified as a new program that will be implemented prior to the period of extended operation as item 23 of the commitments.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.27, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program as identified in the SRP-LR FSAR supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.9.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).



3.0.3.1.10 STRUCTURES MONITORING- MASONRY WALL PROGRAM (PNPS AMP B.1.29.1)

In PNPS LRA, Appendix B, Section B.1.29.1, the applicant stated that PNPS AMP B.1.29.1, "Structures Monitoring - Masonry Wall Program," is an existing plant program that is consistent with GALL AMP XI.S5, "Masonry Wall Program."

3.0.3.1.10.1 Program Description

The applicant stated, in the PNPS LRA, that this program will manage aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation.

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

Masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

3.0.3.1.10.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.29.1 is consistent with GALL AMP XI.S5.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.29.1, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.21.2 "Masonry Wall Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.S5. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.29.1 and associated bases documents to determine consistency with GALL AMP XI.S5.

The project team also reviewed PNPS procedure: "Building & Structures System 56," MRSSC58, Revision 1; "Structure Inspection and Condition Monitoring," NE8.02, Revision 3.

The project team reviewed those portions of the applicant's Structures Monitoring - Masonry Wall Program for which the applicant claims consistency with GALL AMP XI.S5 and found that Pilgrim Masonry Wall Program is consistent with the program described in NUREG-1801, Section XI.S5. Masonry Wall Program includes the guidance and lessons learned from NRC IEB 80-11 and IN 87-67. As indicated in Aging Management Program Evaluation Report, LRPD-02, Section 4.21.2, operating experience shows that this program has been effective in managing aging effects with consideration for recommendations and lessons learned from IEB 80-11 and IN 87-67. Masonry walls are visually examined at frequency selected (at least one every 10 years) to ensure there is no loss of intend function between inspections. PNPS Engineering Design Standards Manual MCSB03.104 defines the procedure to maintain the qualification of safety-related masonry block walls in accordance with the provisions on NRC Inspection and Enforcement Bulletin (IEB) 80-11, Masonry Wall Design. PNPS procedure "Structure Inspection and Condition Monitoring," NE8.02, Section 5.0 stated: "...The inspection intervals are once every 3 years for accessible areas, once every 10 years for normally inaccessible areas." The applicant also stated that no additional masonry walls have been identified to be added to the scope of Pilgrim and thus they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Structures Monitoring - Masonry Wall Program provided reasonable assurance that the Masonry Wall Program will be adequately managed for the period of extended operation. The project team found the applicant's Structures Monitoring - Masonry Wall Program acceptable because it conforms to the recommended GALL AMP XI.S5, "Masonry Wall Program."

3.0.3.1.10.3 <u>Exceptions to the GALL Report</u>

None

3.0.3.1.10.4 <u>Enhancements</u>

None

3.0.3.1.10.5 <u>Operating Experience</u>

The applicant stated, in the PNPS LRA, that examinations of masonry walls within the scope of license renewal in 2002 did not find evidence of cracking. A review of condition reports from 1998 through 2004 did not reveal any instances of cracked masonry walls. Absence of cracking provides evidence that the program is effective for managing cracking of masonry walls.

The project team also reviewed the operating experience provided in the PNPS 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.

The project team recognized that the corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

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 concluded that the applicant's Structures Monitoring - Masonry Wall Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.10.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Structures Monitoring - Masonry Wall Program in PNPS LRA, Appendix A, Section A.2.1.31, which states that the objective of the Masonry Wall Program is to manage cracking so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation.



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

Masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.29.1, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.10.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.11 SYSTEM WALKDOWN PROGRAM (PNPS AMP B.1.30)

In PNPS LRA, Appendix B, Section B.1.30, the applicant stated that PNPS AMP B.1.30, "System Walkdown Program," is an existing plant program that is consistent with GALL AMP XI.M36, "External Surfaces Monitoring."

3.0.3.1.11.1 Program Description

The applicant stated, in the PNPS LRA, that this program entails inspections of external surfaces of components subject to aging management review. The program is also credited with managing loss of material from internal surfaces, for situations in which internal and external material and environment combinations are the same such that external surface condition is representative of internal surface condition.

3.0.3.1.11.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.30 is consistent with GALL AMP XI.M36.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.30, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.22, "System Walkdown Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M36. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.30 and associated bases documents to determine consistency with GALL AMP XI.M36.

During the audit and review, the project team asked the applicant why an enhancement to the scoping of System Walkdown Program is listed in the LRPD-02, but is not listed in the LRA. The applicant explained that this enhancement was identified after the LRA was submitted to NRC for review, and this enhancement will be added to the LRA Section B.1.30 as described in Section 3.0.3.1.11.4 of this report.

The project team reviewed those portions of the applicant's System Walkdown Program for which the applicant claims consistency with GALL AMP XI.M36 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's System Walkdown Program provided reasonable assurance that the effects of aging will be managed during the period of extended operation. The project team found the applicant's System Walkdown Program acceptable because it conforms to the recommended GALL AMP XI.M36, "External Surfaces Monitoring."

3.0.3.1.11.3 Exceptions to the GALL Report

None.

3.0.3.1.11.4 Enhancements

During the audit and review, the project team noted that the LRPD-02 identifies an enhancement to the System Walkdown Program, but this enhancement was not listed in the LRA. In its letter dated **xx-yy, 2006 (MIxxxxx)**, the applicant stated that this enhancement will be added to LRA Section B.1.30, Enhancement Section as follows:

Element: 1. Scope of Program

Enhancement: Enhance system walkdown guidance documents to clarify a license renewal commitment. The commitment for license renewal is for periodic system engineer inspections of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(2).

The GALL Report identified the following recommendation for the "Scope of Program" program element associated with the enhancement:

> **Scope of Program:** This program visually inspects the external surface of in-scope components and monitors external surfaces of steel components in systems within the scope of license renewal and subject to AMR for loss of material and leakage. Visual inspections are expected to identify loss of material due to general corrosion in accessible steel components. Loss of material due to pitting and crevice corrosion may not be detectable through these same visual inspections; however, general corrosion is expected to be present and detectable such that, should pitting and crevice corrosion exist, general corrosion will manifest itself as visible rust or rust byproducts (e.g., discoloration or coating degradation) and be detectable prior to any loss of intended function. Therefore, this program is acceptable for use in inspecting for loss of material for general, pitting, and crevice corrosion.
>
> Surfaces that are inaccessible or not readily visible during plant operations are inspected during refueling outages. Surfaces that are inaccessible or not readily visible during both plant operations and refueling outages are inspected at such intervals that would provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation.
>
> Surfaces that are insulated may be inspected when the external surface is exposed (i.e., maintenance) at such intervals that would provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation.
>
> The program may also be credited with managing loss of material from internal surfaces, for situations in which material and environment combinations are the same for internal

and external surfaces such that external surface condition is representative of internal surface condition. When credited, the program should describe the component internal environment and the credited similar external component environment inspected.

The project team reviewed the applicant's enhancement and the plant procedure ("System Walkdowns," EN-DC-178)and determined this enhancement acceptable because this enhancement will make the program consistent with GALL AMP XI.M36, element 1.

On this basis, the project team found this enhancement acceptable because when the enhancement is implemented, PNPS AMP B.1.30, "System Walkdown Program," will be consistent with GALL AMP XI.M36 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.1.11.5 Operating Experience

The applicant stated, in the PNPS LRA, that system walkdowns between 1998 and 2004 identified evidence of aging effects including corrosion and leakage. Examples include fire water storage tank and diesel fire pump fuel oil day tank leakage, through-wall leakage on salt service water (SSW) piping, signs of corrosion in fan room and auxiliary bays, and through-wall leakage on a drain line to the aux bay sump. Corrective actions were accomplished in accordance with the site Corrective Action Program. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for passive components.



The project team reviewed the condition reports related to through-wall leakage on a drain line to the aux bay sump (CR-PNP-2003-04416), diesel fire pump fuel oil day tank leakage (CR-PNP-2001-01491), and through-wall leakage on SSW piping (CR-PNP-1999-09359) and found these condition reports have been properly closed and the associated corrective actions have been taken to correct the identified problems. The project team also sample reviewed System Health Reports/System Performance Reports on the Salt Service Water System, which covered the period from January 1, 2006, to March 31, 2006. The report indicates that the SSW system is classified as green, and the system continues to perform well without indication of any major issues.

The project team also reviewed the operating experience provided in the PNPS 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 concluded that the applicant's System Walkdown Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.11.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the System Walkdown Program in PNPS LRA, Appendix A, Section A.2.1.34, which states that the System Walkdown Program entails inspections of external surfaces of components subject to aging management review. The program is also credited with managing loss of material from internal surfaces, for situations in which internal and external material and environment combinations are the same such that external surface condition is representative of internal surface condition.

Surfaces that are inaccessible during plant operations are inspected during refueling outages. Surfaces are inspected at frequencies to provide reasonable assurance that effect of aging will be managed such that applicable components will perform their intended function during the period of extended operation.

During the audit and review, the project team noted that the LRPD-02 identifies an enhancement to the System Walkdown Program, but this enhancement was not listed in the LRA. In its letter dated **xx-yy, 2006 (MIxxxxx)**, the applicant stated that this enhancement will be added to LRA Section B.1.30, Enhancement Section. The applicant also stated that the program description in Appendix A will be revised to identify the commitment number associated with the enhancement for the System Walkdown Program as described in the supplemented LRA Appendix B. The programdescription in Appendix A will be amended to include the following statement:

License renewal commitment number X specifies enhancement to this program. This will require an amendment to the license renewal application. **{OPEN ITEM}**

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.30, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.11.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 THERMAL AGING AND NEUTRON IRRADIATION EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL (CASS) PROGRAM (PNPS AMP B.1.31)

In PNPS LRA, Appendix B, Section B.1.31, the applicant stated that PNPS AMP B.1.31, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program," is a new plant program that is consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)."

3.0.3.1.12.1 Program Description

The applicant stated, in the PNPS LRA, that this program will assure that reduction of fracture toughness due to thermal aging and reduction of fracture toughness due to radiation embrittlement will not result in loss of intended function. This program will evaluate CASS components in the reactor vessel internals and require nondestructive examinations as appropriate.

The applicant also stated, in the PNPS LRA, that EPRI, the BWR Owners Group and other industry groups are focused on reactor vessel internals to ensure a better understanding of aging effects. Future Boiling Water Reactor Vessel Internals Project (BWRVIP) reports, EPRI reports, and other industry operating experience will provide additional bases for evaluations and inspections under this program. This program will supplement reactor vessel internals inspections required by the BWR Vessel Internals Program to assure that aging effects do not result in loss of the intended functions of reactor vessel internals during the period of extended operation.

The program will be initiated prior to the period of extended operation.

3.0.3.1.12.2 Consistency with the GALL Report



In PNPS LRA, the applicant stated that PNPS AMP B.1.31 will be consistent with GALL AMP X.M13.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.31, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.1, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program," which provides an assessment of the AMP elements' consistency with GALL AMP X.M13. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.31 and associated bases documents to determine consistency with GALL AMP X.M13.

The project team reviewed those portions of the applicant's Thermal Aging and Neutron Irradiation Embrittlement of CASS Program for which the applicant claims consistency with GALL AMP X.M13 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Thermal Aging and Neutron Irradiation Embrittlement of CASS Program provided reasonable assurance that the integrity of CASS components will be maintained during period of extended operation. The project team found the applicant's Thermal Aging and Neutron Irradiation Embrittlement of CASS Program acceptable because it conforms to the recommended GALL AMP X.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)."

3.0.3.1.12.3 Exceptions to the GALL Report

None

3.0.3.1.12.4 Enhancements

None

3.0.3.1.12.5 Operating Experience

The applicant stated, in the PNPS LRA, that the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is a new program for which there is no operating experience.

The project team also reviewed the operating experience provided in the basis document and interviewed the applicant's technical staff to confirm that no industry operating experience with thermal aging and neutron irradiation embrittlement of CASS has emerged.

The project team recognized that the corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

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 concluded that the applicant's Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.



3.0.3.1.12.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program in PNPS LRA, Appendix A, Section A.2.1.35, which states that the purpose of the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is to assure that reduction of fracture toughness due to thermal aging and reduction of fracture toughness due to radiation embrittlement will not result in loss of intended function during the period of extended operation. This program evaluates CASS components in the reactor vessel internals and requires non-destructive examinations, as appropriate.

The project team also reviewed the applicant's license renewal commitment list in Appendix A of the PNPS LRA and confirmed that this program is identified as a new program that will be implemented prior to the period of extended operation as item 29 of the commitments.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.31, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.12.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.13 <u>WATER CHEMISTRY CONTROL – BWR PROGRAM (PNPS AMP B.1.32.2)</u>

In PNPS LRA, Appendix B, Section B.1.32.2, the applicant stated that PNPS AMP B.1.32.2, "Water Chemistry Control – BWR Program," is an existing plant program that is consistent with GALL AMP XI.M2, "Water Chemistry."

3.0.3.1.13.1 <u>Program Description</u>

The applicant stated, in the PNPS LRA, that this program will manage aging effects caused by corrosion and cracking mechanisms. The program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (BWRVIP-130). BWRVIP-130 has three sets of guidelines: one for primary water, one for condensate and feedwater, and one for control rod drive (CRD) mechanism cooling water. EPRI guidelines in BWRVIP-130 also include recommendations for controlling water chemistry in the torus, condensate storage tanks, demineralized water storage tanks, and spent fuel pool.



The Water Chemistry Control – BWR Program optimizes the primary water chemistry to minimize the potential for loss of material and cracking. This is accomplished by limiting the levels of contaminants in the RCS that could cause loss of material and cracking. Additionally, PNPS has instituted hydrogen water chemistry (HWC) to limit the potential for intergranular stress corrosion cracking (IGSCC) through the reduction of dissolved oxygen in the treated water.

3.0.3.1.13.2 <u>Consistency with the GALL Report</u>

In PNPS LRA, the applicant stated that PNPS AMP B.1.32.2 is consistent with GALL AMP XI.M2.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.32.2, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.23.2, "Water Chemistry Control - BWR Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M2. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.32.2 and associated bases documents to determine consistency with GALL AMP XI.M2.

The project team also reviewed Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.28, "Water Chemistry Control - BWR Program;" PNPS Procedure No. 7.8.1, Rev. 40, Chemistry Sample and Analysis Program Procedure; and PNPS Procedure No. 7.8.7, Rev.

1, Recording and Trending of Chemistry Data Procedure.

In the LRA, the applicant stated that the program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (BWRVIP-130). BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines including BWRVIP-29 (TR-103515). The project team reviewed EPRI TR-1008192, which is based on updated industry experience with increased emphasis on fuel performance concerns while retaining chemistry parameters, action levels, and associated measurement frequencies essentially unchanged. The staff has previously performed a technical review of EPRI TR-1008192 (BWRVIP-130) and accepted it as documented in the Monticello Nuclear Plant SER. Based on the project team review of the document and the staff's acceptance on the Monticello Plant, the project team found the use of BWRVIP-130 to be acceptable.

During the audit and review, the project team noted that GALL AMP XI.M2, element 3, Parameters Monitored/Inspected, lists monitoring of chlorides, sulfates, dissolved oxygen, and hydrogen peroxide. However, LRPD-02, Section 4.23.2.B.3.b, which performs a comparison of GALL element 3 with the PNPS AMP, does not mention monitoring of hydrogen peroxide and concludes that the PNPS AMP is consistent with the element. The project team asked the applicant to clarify how, if hydrogen peroxide is not monitored, PNPS is consistent with this element. In its response, the applicant stated that reactor water hydrogen peroxide measurements are not practical even though they would be beneficial in determining the total oxidizing species affecting Stress Corrosion Cracking (SCC). The results obtained through liquid sampling are inaccurate due to decomposition of hydrogen peroxide in the sample lines. No practical method exists for a BWR to obtain direct hydrogen peroxide measurements. In accordance with BWRVIP-130, reactor water Electrochemical Corrosion Potential (ECP) and dissolved oxygen measurements are used at PNPS to determine whether oxidizing species including $H_2O_2$ have been reduced sufficiently to minimize IGSCC.

Measurement of ECP and dissolved oxygen, as recommended by BWRVIP-130, is used to ensure that oxidizing species including $H_2O_2$ have been reduced, which in turn minimizes IGSCC. On this basis, the project team found the applicant response acceptable.

GALL chapter XI.M2 recommends that for "susceptible locations", a one-time inspection verification program may be appropriate. The project team asked the applicant if it intended to implement a one-time inspection program for this water chemistry control program. If so, the applicant was asked why this is not included in the UFSAR Supplement Appendix A for this program. In its response, the applicant stated yes, the one-time inspection program described in LRA Section B.1.23 includes inspections to verify the effectiveness of the water chemistry control aging management programs by confirming that unacceptable cracking, loss of material, and fouling is not occurring. The discussions in LRA Section 3, Table 1 provide the link between the One-Time Inspection and Water Chemistry Control Program for susceptible components. However, for clarity, LRA Appendix A descriptions for the Water Chemistry Control - BWR Program will be amended to provide a link to the One-Time Inspection Program activities to confirm the effectiveness of these programs. **This requires an amendment to the LRA. (Open Item).** Based on changes to the Appendix A write-up, the applicant response was found acceptable.

The project team reviewed those portions of the applicant's Water Chemistry – BWR Program for which the applicant claims consistency with GALL AMP XI.M2 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Water Chemistry – BWR Program provided reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Water Chemistry – BWR Program acceptable because it conforms to the recommended GALL AMP XI.M2, "Water Chemistry."

3.0.3.1.13.3 Exceptions to the GALL Report

None.

3.0.3.1.13.4 Enhancements

None.

3.0.3.1.13.5 Operating Experience

The applicant stated, in the PNPS LRA, that during the period from 1998 through 2004, several condition reports were initiated due to adverse trends in parameters monitored by the Water Chemistry Control – BWR Program. Corrective actions were taken within the Corrective Action Program to preclude reaching unacceptable values for the parameters. Continuous confirmation of water quality and corrective action prior to reaching control limits provide evidence that the program is effective in managing aging effects for applicable components.

During the period from 1998 through 2004, several condition reports were initiated due to parameters monitored by the Water Chemistry Control – BWR Program outside of administrative limits, but still within EPRI acceptance criteria. Corrective actions were taken within the Corrective Action Program to preclude violating EPRI acceptance criteria. Continuous confirmation of water quality and corrective action prior to reaching control limits provide evidence that the program is effective in managing aging effects for applicable components.

During the period from 1998 through 2004, the following two incidents were found in which parameters monitored by the Water Chemistry Control – BWR Program were outside of EPRI acceptance criteria.

- Following a downpower on March 29, 2002, dissolved oxygen measurement from the B high-pressure feedwater (HPFW) train was ~28 ppb, below the minimum required reading of 30 ppb (EPRI action level 1). Dissolved oxygen measured from the A HPFW train and condensate demineralizer effluent (CDE) were acceptable (~ 70 to 80 ppb). Root cause was B HPFW sample line contamination, not actual low oxygen in the feedwater. The B HPFW sample line was replaced.

- On October 28, 2002, HPFW and CDE dissolved oxygen levels spiked to 400 to 500 ppb for about 15 minutes before returning to normal. EPRI action level 1 for HPFW dissolved oxygen is 200 ppb. Root cause was determined to be inadequate filling of the D demineralizer prior to its return to service. The procedure states, "It is EXTREMELY important that all air is vented from a condensate demineralizer before it is placed in service to prevent air injection into the Feedwater System." Procedural steps were emphasized that will insure proper venting and mitigate elevated oxygen levels in the feedwater system.

Continuous confirmation of water quality and timely corrective action provide evidence that the program is effective in managing aging effects for applicable components.

QA audits in 2000 and 2002 revealed no issues or findings that could impact effectiveness of the program.

A QA audit in 2004 revealed that reactor coolant sodium and lithium analyses were not being performed weekly during the first half of 2004. Corrective action was taken to replace the analysis instrument and ensure required analyses are performed. Confirmation of water quality and timely corrective actions provide evidence that the program is effective in managing aging effects for applicable components.

A corporate assessment in 2003 identified areas for improvement in administrative controls, but revealed no issues or findings that could impact effectiveness of the program.

The project team also reviewed the operating experience provided in the PNPS 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. The project team reviewed Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.28, "Water Chemistry Control - BWR Program." Several instances where the limit levels were exceeded are identified, with appropriate actions taken. The program is effective in managing aging effects. The project team also reviewed CR-PNP-2002-09754, which was generated because feedwater oxygen was below EPRI Action I guidelines. The project team reviewed the CR and determined that appropriate root cause analysis as required by this program was performed and the necessary corrective actions were completed.

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 concluded that the applicant's Water Chemistry Control - BWR Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.13.6 <u>UFSAR Supplement</u>

The applicant provided its UFSAR Supplement for the Water Chemistry Control – BWR Program in PNPS LRA, Appendix A, Section A.2.1.37, which states that the purpose of the Water Chemistry Control – BWR Program is to manage aging effects caused by corrosion and cracking mechanisms. The program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (BWRVIP-130). BWRVIP-130 has three sets of guidelines: one for primary water, one for condensate and feedwater, and one for control rod drive (CRD) mechanism cooling water. EPRI guidelines in BWRVIP-130 also include recommendations for controlling water chemistry in the torus, condensate storage tank, demineralized water storage tanks, and spent fuel pool.

The Water Chemistry Control – BWR Program optimizes the primary water chemistry to minimize the potential for loss of material and cracking. This is accomplished by limiting the levels of contaminants in the RCS that could cause loss of material and cracking. Additionally, PNPS has instituted hydrogen water chemistry (HWC) to limit the potential for IGSCC through the reduction of dissolved oxygen in the treated water.

As stated above in Section 3.0.3.1.13.2, the UFSAR Supplement will be amended to provide a link to the One-Time Inspection Program activities to confirm the effectiveness of this water chemistry control program. **(Open Item)**

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.32.2, found that it was consistent with the GALL Report, and determined that it provided an adequate summary description of the program as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.1.13.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found 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 found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

### 3.0.3.2 PNPS AMPs That Are Consistent with the GALL Report with Exceptions and/or Enhancements

3.0.3.2.1 BURIED PIPING AND TANKS INSPECTION PROGRAM (PNPS AMP (B.1.2)

In PNPS LRA, Appendix B, Section B.1.2, the applicant stated that PNPS AMP B.1.2, "Buried Piping and Tanks Inspection Program," is a new plant program that is consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with an exception.

3.0.3.2.1.1 Program Description

The applicant stated, in the PNPS LRA, that this program includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance.

A focused inspection will be performed within the last 10 years and within the first 10 years of the period of extended operation unless an opportunistic inspection (or an inspection via a method that allows assessment of pipe condition without excavation) occurs within this 10-year period.

3.0.3.2.1.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.2 is consistent with GALL AMP XI.M34 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 audit and review report for PNPS AMP B.1.2, including AMPER, 3.1, "Buried Piping and Tanks Inspection Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M34. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.2 and associated bases documents to determine consistency with GALL AMP XI.M34.

The project team reviewed those portions of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program for which the applicant claims consistency with GALL AMP XI.M34 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program provides reasonable assurance that the program is acceptable. The project team found the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program acceptable because it conforms to the recommended GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with the exception as described below.

3.0.3.2.1.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

Exception

Element: 4: Detection of Aging Effects
Exception: For cases of excavation solely for the purpose of inspection — methods such as "phased array ultrasonic thickness (UT)" will be used to determine wall thickness.

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

> Inspections performed to confirm that coating and wrapping are intact are an effective method to ensure that corrosion of external surfaces has not occurred and the intended function is maintained. Buried piping and tanks are opportunistically inspected whenever they are excavated during maintenance. When opportunistic, the inspections are performed

in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems, within the areas made accessible to support the maintenance activity.

The applicant stated, in the PNPS LRA, that for cases of excavation solely for the purpose of inspection, methods such as "phased array UT" will be used to determine wall thickness. This is considered preferable by PNPS since excavation could result in damage to coatings or wrappings.

The proposed exception eliminates the possibility of inadvertent damage during inspection, while still being able to assess the target component. On this basis, the project team found this exception acceptable.

3.0.3.2.1.4 <u>Operating Experience</u>

The applicant stated, in the PNPS LRA, that the Buried Piping and Tanks Inspection Program at PNPS is a new program for which there is no operating experience.

No operating experience currently exists. **Additional information will be requested during the AMR audit.**

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Buried Piping and Tanks Inspection Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.1.5 <u>UFSAR Supplement</u>

The applicant provided its UFSAR Supplement for the Buried Piping and Tanks Inspection Program in PNPS LRA, Appendix A, Section A.2.1.2, which states that the Buried Piping and Tanks Inspection Program includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance. If trending within the corrective action program identifies susceptible locations, the areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement.

A focused inspection will be performed within the first 10 years of the period of extended operation, unless an opportunistic inspection (or an inspection via a method that allows assessment of pipe condition without excavation) occurs within this 10-year period.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.2, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.1.6 <u>Conclusion</u>

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 <u>BWR CONTROL ROD DRIVE RETURN LINE NOZZLE PROGRAM (PNPS AMP B.1.3)</u>

In PNPS LRA, Appendix B, Section B.1.3, the applicant stated that PNPS AMP B.1.3, "BWR Control Rod Drive Return Line Nozzle Program," is an existing plant program that is consistent with GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle," with exceptions.

3.0.3.2.2.1 <u>Program Description</u>

The applicant stated, in the PNPS LRA, that this program is comparable to the program described in NUREG-1801, Section XI.M6, BWR Control Rod Drive Return Line Nozzle.

Under this program, PNPS has cut and capped the CRD return line nozzle to mitigate cracking, and continues Inservice Inspection (ISI) examinations to monitor the effects of crack initiation and growth on the intended function of the control rod drive return line nozzle and cap.

In 2003, a structural weld overlay was installed over a crack in the CRD return line nozzle-to-cap weld. The Inconel 52 weld metal used in the overlay is highly resistant to stress corrosion cracking.

3.0.3.2.2.2 <u>Consistency with the GALL Report</u>

In the PNPS LRA, the applicant stated that PNPS AMP B.1.3 is consistent with GALL AMP XI.M6, 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 audit and review report for PNPS AMP B.1.3, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.2, "BWR Control Rod Return Line Nozzle," which provides an assessment of the AMP elements' consistency with GALL AMP AMP XI.M6. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.3 and associated bases documents to determine consistency with GALL AMP XI.M6.

The project team also reviewed the documents listed in Appendix 5.

The project team reviewed those portions of the BWR Control Rod Drive Return Line Nozzle Program for which the applicant claims consistency with GALL AMP XI.M6 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's BWR Control Rod Drive Return Line Nozzle Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's BWR Control Rod Drive Return Line Nozzle Program acceptable because it conforms to the recommended GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle," with the exceptions as described below.

3.0.3.2.2.3 <u>Exceptions to the GALL Report</u>

The applicant stated, in the PNPS LRA, that the exceptions to the GALL Report program elements are as follows:

<u>Exception 1</u>

Element: 3: Parameters Monitored/Inspected

Exception: The Applicant examines ½ inch of the volume next to the N10 nozzle rather than ½ of the vessel wall thickness.

The GALL Report identified the following recommendation for the "Parameters Monitored/Inspected" program element associated with the exception taken:

> The aging management program (AMP) monitors the effects of cracking on the intended function of the CRDRL nozzles by detecting and sizing cracks by ISI in accordance with Table IWB 2500-1 and NUREG-0619.

The applicant stated, in the PNPS LRA, that the reduced examination volume for the CRD Return Line Nozzle to Vessel Weld is described in the LRA Appendix B.1.3. This reduction of the inspection volume for the adjacent base metal is now in accordance with ASME Code Case N-613-1, which has been approved for use by the NRC in Regulatory Guide 1.147 Rev. 14, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1."

This LRA information will be updated to reflect the current status of this Code Case approval. It is acceptable to use NRC Approved code cases that are included in Regulatory Guide 1.147. On this basis, the project team found this exception acceptable.

<u>Exception 2</u>

Elements: 4: Detection of Aging Effects

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5: Monitoring and Trending
Exception: The Applicant does not follow the extent and schedule of inspections.

The GALL Report identified the following recommendations for the "Detection of Aging Effects" and "Monitoring and Trending" program elements associated with the exception taken:

**Detection of Aging Effects:** The extent and schedule of inspection, as delineated in NUREG-0619, assures detection of cracks before the loss of intended function of the CRDRL nozzles. Inspection recommendations include liquid penetrant testing (PT) of CRDRL nozzle blend radius and bore regions and the reactor vessel wall area beneath the nozzle, return-flow-capacity demonstration, CRD-system-performance testing, and ultrasonic inspection of welded connections in the rerouted line. The inspection is to include base metal to a distance of one-pipe-wall thickness or 0.5 in., whichever is greater, on both sides of the weld.

**Monitoring and Trending:** The inspection schedule of NUREG-0619 provides timely detection of cracks.

The applicant stated, in the PNPS LRA, that the CRD Return Line Nozzle N-10 weld overlay repair will continue to be inspected under the PNPS Inservice Inspection Program as a Category E weld in accordance with BWRVIP-75-A "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules" during PEO. Check to see if this is an approved VIP. The project team finds that this is an acceptable exception to these elements because this BWRVIP has been review and accepted by the staff. On this basis, the project team found this exception acceptable.

3.0.3.2.2.4 <u>Enhancements</u>

None.

3.0.3.2.2.5 <u>Operating Experience</u>

The applicant stated, in the PNPS LRA, that on October 1, 2003, a reactor coolant pressure boundary leak from the N10 nozzle-to-cap weld area was identified during a planned visual inspection of the drywell. Through-wall leakage from the N10 nozzle-to-cap butt weld was caused by an incipient crack or crevice condition remaining in the weld after repair welding performed as part of the nozzle-to-cap fabrication welding in 1977. Subsequent crack propagation continued through-wall by an interdendritic stress corrosion cracking mechanism due to high residual weld stresses in the alloy 82/182 weld metal as a result of the repair. A structural weld overlay was installed with alloy 52 weld metal, which is highly resistant to stress corrosion cracking. The weld overlay process also imparts a compressive residual stress due to the welding process, which prevents further crack growth.

The N10 nozzle-to-cap weld received all code-required preservice NDE examinations and was pressure tested prior to returning to service. Ultrasonic examinations have the capability to detect incipient cracking including hard-to-detect flaws related to stress corrosion cracking mechanisms and flaws that occur entirely within the weld metal. Thus, the examinations would have detected weld cracking. Since the weld overlay is highly resistant to cracking, and will continue to be examined as required, the BWR CRD Return Line Nozzle Program remains effective for managing the effect of cracking on the intended function of the CRD return line nozzle.

The CRD Return Line Weld overlay was designed and installed in accordance with ASME Section XI Code Case N-504-2, "Alternate Rules for Repair of Class 1, 2 and 3 Austenitic Stainless Steel Piping," and Code Case N-638, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique," and associated Relief Request PRR-36 and PRR-38. Both code cases were approved for use in NRC Regulatory Guide 1.147, Revision 13. ASME Section XI Code Case N-504-2 allows a repair to be preformed by either removing the flaw or reducing it to an acceptable size. The weld overlay approach, by design, reduces the flaw to an acceptable size. The weld overlay assumes a flaw size through wall for 360 degrees around the component. The weld overlay is designed to structurally replace the cross-section of the underlying component such that no structural credit is taken for the remaining ligaments of the component.

Code Case N-504-2 is the basis for the design and implementation of the structural weld overlay repair method. Code Case N-638 is used for the application of the temper bead technique for repair welding of dissimilar metals using the GTAW process. Code Case N-638 provides the applicable procedure qualification requirements for welding with nickel-based alloys on a ferritic base metal, which in this case includes welding to both a P-No. 3 low alloy carbon steel nozzle and a P-No. 43 nickel-chrome alloy pipe cap.

It was necessary to take exceptions to the specific alloys described in the Code Case N-504-2 overlay repair method, which is based on the use of austenitic stainless steel alloys only. These specific exceptions are described in the Pilgrim Relief Request PRR-36.
Additionally, relief was requested, via Pilgrim Relief Request PRR-38, to use an alternative program for implementation of ASME XI Appendix VIII, Supplement 11 for ultrasonic examinations. The alternative program was implemented through the Performance Demonstration Initiative (PDI) program.

The CRD Return Line Nozzle N-10 weld overlay repair will continue to be inspected under the PNPS Inservice Inspection Program as a Category E weld in accordance with BWRVIP-75-A "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules" during PEO.

PNPS commits (Commitment #30) to perform a code repair of the CRD return nozzle to cap weld as needed if the installed overlay weld repair is not approved via accepted code cases, revised codes, or subsequent approval of relief requests.

The N-10 nozzle weld overlay was inspected to the maximum extent physically possible based on the geometric limitations of the nozzle and examination equipment used. The examination volume is based on the component wall.

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's BWR CRD Return Line Nozzle Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.2.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the BWR Control Rod Drive Return Line Nozzle Program in PNPS, Appendix A, Section A.2.1.3, which states that the BWR CRD Return Line Nozzle Program cut and capped the CRD return line nozzle to mitigate cracking and continues inservice inspection (ISI) examinations to monitor the effects of crack initiation and growth on the intended function of the control rod drive return line nozzle and cap. ISI examinations include ultrasonic inspection of the nozzle-to-vessel weld and ultrasonic inspection of the dissimilar metal weld overlay at the nozzle.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.3, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).



3.0.3.2.2.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 BWR FEEDWATER NOZZLE PROGRAM (PNPS AMP B.1.4)

In PNPS LRA, Appendix B, Section B.1.4, the applicant stated that PNPS AMP B.1.4, "BWR Feedwater Nozzle Program," is an existing plant program that is consistent with GALL AMP XI.M5, "BWR Feedwater Nozzle," with exceptions.

3.0.3.2.3.1 Program Description

The applicant stated, in the PNPS LRA, that under this program, PNPS has removed feedwater blend radii flaws, removed feedwater nozzle cladding, and installed a triple-sleeve-double-piston sparger to mitigate cracking. This program continues enhanced ISI of the feedwater nozzles in accordance with the requirements of ASME Section XI, Subsection IWB and the recommendation of General Electric (GE) NE-523-A71-0594 to monitor the effects of cracking on the intended function of the feedwater nozzles.

3.0.3.2.3.2 <u>Consistency with the GALL Report</u>

In the PNPS LRA, the applicant stated that PNPS AMP B.1.4 is consistent with GALL AMP XI.M5, 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 audit and review report for PNPS AMP B.1.4, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section B.1.4, "BWR Feedwater Nozzle Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M5. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.4 and associated bases documents to determine consistency with GALL AMP XI.M5. The project team also reviewed the documents listed in Appendix 5.

The project team reviewed those portions of the BWR Feedwater Nozzle Program for which the applicant claims consistency with GALL AMP XI.M5 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's BWR Feedwater Nozzle Program provides reasonable assurance that the effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's BWR Feedwater Nozzle Program acceptable because it conforms to the recommended GALL AMP XI.M5, "BWR Feedwater Nozzle," with the exceptions as described below.

3.0.3.2.3.3 <u>Exceptions to the GALL Report</u>

The applicant stated, in the PNPS LRA, that the exceptions to the GALL Report program elements are as follows:

<u>Exception 1</u>

| | |
|---|---|
| Elements: | 2: Preventive Actions |
| Exception: | A low-flow controller was not installed and the reactor water cleanup system was not rerouted. |

The GALL Report identified the following recommendations for the "Preventive Actions" program element associated with the exception taken:

> Mitigation occurs by systems modifications, such as removal of stainless steel cladding and installation of improved spargers. Mitigation is also accomplished by changes to plant-operating procedures, such as improved feedwater control and rerouting of the reactor water cleanup system, to decrease the magnitude and frequency of temperature

fluctuations.

The applicant stated, in the PNPS LRA, that in its safety evaluation of BWR feedwater and CRD return line modifications at PNPS, NRC noted that the intent of the requirements of NUREG-0619 and NEDE-21821-A had been satisfied with the PNPS modifications. Since the stainless steel cladding has been removed and the improved spargers have been installed, an adequate of margin of safety against feedwater nozzle crack growth exists. Therefore, NRC concluded that, with continued inspections to monitor for crack initiation and growth, PNPS can operate without rerouting the reactor water clean up and without installing a low-flow controller for the feedwater system. Since inspections to monitor for crack initiation and growth will continue, this conclusion remains valid for the period of extended operation.

The project team reviewed the relevant documents and agreed that the previous staff conclusio ns remain valid for the period of extended operation. On this basis, the project team found this exception acceptable.

<u>Exception 2</u>

Element: 3: Parameters Monitored/Inspected
Exception: The applicant reduced the examination volume next to the widest part of the feedwater nozzle-to-vessel welds from half the vessel wall thickness to ½ inch.



The GALL Report identified the following recommendations for the "Parameters Monitored/Inspected" program element associated with the exception taken:

> The aging management program (AMP) monitors the effects of cracking on the intended function of the component by detection and sizing of cracks by ISI in accordance with ASME Section XI, Subsection IWB and the recommendation of GE NE-523-A71-0594.

The applicant stated, in the PNPS LRA, that expanding the examination volume into the base metal as required by ASME Section XI, 1998 Edition, 2000 Addenda, Figure IWB-2500-7(b) prolongs the examination time significantly and results in no net increase in safety. The extra volume is base metal which is not prone to inservice cracking and has been extensively examined before the vessel was put into service and during the first, second, and third interval examinations.

The project staff questioned the regulatory basis for reducing the examination volume. The applicant replied that the reduced volume inspected is in accordance with ASME Code Case –613-1, which has been endorsed by the NRC in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." The use of endorsed code cases is acceptable to the NRC staff. On this basis, the project team found this exception acceptable.

3.0.3.2.3.4 <u>Enhancements</u>

None.

3.0.3.2.3.5 Operating Experience

The applicant stated, in the PNPS LRA, that in October 1989, it was discovered that feedwater nozzles were not being examined with scans designed for the bore. Procedures were revised and subsequent examinations were performed in accordance with NUREG-0619. Since feedwater nozzle bores have subsequently been examined without recordable indications, and will continue to be examined as required, this programmatic error did not impact the ability of the BWR Feedwater Nozzle Program to manage the effect of cracking on the intended function of the feedwater nozzles.

Ultrasonic testing of the feedwater nozzles during RFO14 (April 2003) resulted in no recordable indications. Absence of recordable indications on the feedwater nozzles provides evidence that the program is effective for managing cracking of the nozzles.

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's BWR Feedwater Nozzle Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.



3.0.3.2.3.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the BWR Feedwater Nozzle Program in PNPS LRA, Appendix A, Section A.2.1.4, which states that under the BWR Feedwater Nozzle Program, PNPS has removed feedwater blend radii flaws, removed feedwater nozzle cladding, and installed a triple-sleeve-double-piston sparger to mitigate cracking. This program continues enhanced inservice inspection (ISI) of the feedwater nozzles in accordance with the requirements of ASME Section XI, Subsection IWB, and the recommendation of GE NE-523-A71-0594 to monitor the effects of cracking on the intended function of the feedwater nozzles.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.4, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.3.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 BWR PENETRATIONS PROGRAM (PNPS AMP B.1.5)

In PNPS LRA, Appendix B, Section B.1.5, the applicant stated that PNPS AMP B.1.5, "BWR Penetrations Program," is an existing plant program that is consistent with GALL AMP XI.M8, "BWR Penetrations," with exceptions.

3.0.3.2.4.1 Program Description

The applicant stated, in the PNPS LRA, that this program includes (a) inspection and flaw evaluation in conformance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) documents BWRVIP-27 and BWRVIP-49 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel penetrations and nozzles.

3.0.3.2.4.2 Consistency with the GALL Report



In the PNPS LRA, the applicant stated that PNPS AMP B.1.5, "BWR Penetrations Program," is consistent with GALL AMP XI.M8, 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 audit and review report for PNPS AMP B.1.5, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.4, BWR Penetrations Program, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M8. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.5 and associated bases documents to determine consistency with GALL AMP XI.M8.

The project team also reviewed PNPS Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.4, BWR Penetrations Program; PNPS-RPT-05-001, Revision 0, "Fourth 10-Year ISI Program Plan" (ML051920157); BWRVIP-27, "BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines," April 1997; and BWRVIP-49, "Instrument Penetration Inspection and Flaw Evaluation Guidelines," March 1998.

The project team reviewed those portions of the BWR Penetrations Program for which the applicant claims consistency with GALL AMP XI.M8 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's BWR Penetrations Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's BWR Penetrations Program acceptable because it conforms to the recommended GALL AMP XI.M8, "BWR Penetrations," with the exceptions as described below.

3.0.3.2.4.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exceptions to the GALL Report program elements are as follows:

Exception 1

Elements: 1: Scope of Program
3: Parameters Monitored/Inspected
4: Detection of Aging Effects

Exception: Surface examinations are not performed on instrument penetration nozzle welds. In accordance with ASME Section XI, Code Case N-578 for elements classified as low risk, inspections to monitor the effects of cracking on the intended function of instrument penetration nozzles (N15A/B and N16A/B) include enhanced visual (VT-2 with insulation removed) examinations during system pressure testing. Also, a UT exam of the N16B safe end-to reducer weld is performed once every 10 years. However, ASME Section XI, Table IWB-2500-1 and BWRVIP-49 (by reference) also recommend surface examinations.

The GALL Report identified the following recommendations for the "Scope of Program," "Parameters Monitored/Inspected," and "Detection of Aging Effects" program elements associated with the exception taken:



**Scope of Program:** The program is focused on managing the effects of cracking due to SCC or IGSCC. The program contains preventive measures to mitigate SCC or IGSCC, inservice inspection (ISI) to monitor the effects of cracking on the intended function of the components, and repair and/or replacement as needed to maintain the ability to perform the intended function.

The inspection and evaluation guidelines of BWRVIP-49 and BWRVIP-27 contain generic guidelines intended to present appropriate inspection recommendations to assure safety function integrity. The guidelines of BWRVIP-49 provide information on the type of instrument penetration, evaluate their susceptibility and consequences of failure, and define the inspection strategy to assure safe operation. The guidelines of BWRVIP-27 are applicable to plants in which the standby liquid control (SLC) system injects sodium pentaborate into the bottom head region of the vessel (in most plants, as a pipe within a pipe of the core plate ΔP monitoring system). The BWRVIP-27 guidelines address the region where the ΔP and SLC nozzle or housing penetrates the vessel bottom head and include the safe ends welded to the nozzle or housing. Guidelines for repair design criteria are provided in BWRVIP-57 for instrumentation penetrations, and BWRVIP-53 for SLC line.

**Parameters Monitored/Inspected:** The program monitors the effects of SCC/IGSCC on the intended function of the component by detection and sizing of cracks by ISI in accordance with the guidelines of approved BWRVIP-49 or BWRVIP-27 and the requirements of the ASME Code, Section XI, Table IWB 2500-1 (2001 edition including the

2002 and 2003 Addenda). An applicant may use the guidelines of BWRVIP-62 for inspection relief for vessel internal components with hydrogen water chemistry, provided that such relief is submitted under the provisions of 10 CFR 50.55a and approved by the staff.

**Detection of Aging Effects:** The evaluation guidelines of BWRVIP-49 and BWRVIP-27 recommend that the inspection requirements currently in ASME Section XI continue to be followed. The extent and schedule of the inspection and test techniques prescribed by the ASME Section XI program are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of the component. Inspection can reveal cracking and leakage of coolant. The nondestructive examination (NDE) techniques appropriate for inspection of BWR vessel internals including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03.

Instrument penetrations and SLC system nozzles or housings are inspected in accordance with the requirements of ASME Section XI, Subsection IWB. Components are examined and tested as specified in Table IWB-2500-1, examination categories B-E for pressure-retaining partial penetration welds in vessel penetrations, B-D for full penetration nozzle-to-vessel welds, B-F for pressure-retaining dissimilar metal nozzle-to-safe end welds, or B-J for similar metal nozzle-to-safe end welds. In addition, these components are part of examination category B-P for pressure-retaining boundary. Further details for examination are described in Chapter XI.M1, "ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD," of this report.



The applicant stated, in the PNPS LRA, that PNPS has implemented risk-informed ISI (RI-ISI) in accordance with ASME Section XI, Code Case N-578. The overall risk to the plant is reduced when RI-ISI is applied because the process concentrates on examining welds that have the greatest risk in terms of consequences of failure and potential degradation. In addition, RI-ISI examinations are focused on those examination volumes where flaws are most likely to be located. As such, RI-ISI does a better job in capturing risk than existing ASME Section XI requirements, which are based on design stresses and random selection. Also, PNPS replaced the original IGSCC-susceptible 304 stainless steel safe end extensions for the N15 and N16 nozzles with more IGSCC-resistant Inconel material.

During the audit and review, the project team asked the applicant to clarify which vessel penetration nozzles are included in the PNPS BWR Penetrations Program and whether these are the only reactor pressure vessel (RPV) instrument penetrations at PNPS. In response to this request, the applicant stated that there are five RPV penetration nozzles in the program, instrument penetrations N15A/B and N16A/B, and SLC/core plate differential pressure instrument penetration N14. The applicant also stated that these are the only instrument partial-penetration weld nozzles at PNPS. The project team reviewed the PNPS piping and instrumentation drawings for nuclear boiler vessel instrumentation together with portions of BWRVIP-27 and BWRVIP-49 and, based on that review, the project team confirmed that the five penetrations identified by the applicant are the only PNPS penetrations recommended by the GALL Report to be within the scope of the BWR Penetrations Program.

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The project team asked the applicant to provide a more detailed discussion and justification of why their BWR Penetrations Program, with the above-described exception, is adequate to manage the aging of the RPV instrument nozzles during the period of extended operation. In response to this request, the applicant stated that for the instrument nozzles the aging effect of cracking is managed by a combination of the BWR Water Chemistry Program and the BWR Penetrations Program. The applicant stated that the combination of mitigation and inspections, with the ASME code exceptions taken, provides adequate aging management for penetrations during the period of extended operation for the following reasons:

> ASME Section XI, Subsection IWB-2500, without exclusions, requires a surface examination of these components. Because the aging effect of interest originates on the inside diameter wall (exposed to treated water >140 deg-F), these surface examinations would only detect a flaw after the flaw propagated thru-wall. The surface examinations would not detect any flaws that are not thru-wall.
>
> The ISI program includes inspection of welds of the same material/environment combinations as the welds within the BWR Penetrations Program. These inspections will provide information on the aging of the subject components. If any indications are found on the similar component inspections (same material/environment combination), sample expansions will lead to more similar locations and, if appropriate, to the actual components in question. Inspection of representative sample locations is acceptable to confirm the aging of the components' material/environment combination.
>
> PNPS performs an enhanced VT-2 of these penetrations, which is in excess of code requirements. The enhancement is that the insulation is removed from the penetrations so that the penetration and welds are viewed directly and specifically during the hydrostatic leak test, insuring the detection of even very small amounts of leakage from this penetration. PNPS will continue to follow BWRVIP-27 guidelines during the period of extended operation, including VT-2 examinations in excess of code requirements for the N15A/B, N16A/B and N14 nozzles. PNPS believes this is the most effective way to monitor the condition of these specific components. Given the code surface exams will only detect through wall failures from the ID, these enhanced VT-2 examinations will find the same thru-wall flaws that the surface exams would find.

The applicant's responses 1) confirm that all required penetrations are included within the scope of their BWR Penetrations Program, 2) state that aging management of penetrations is provided by the BWR Water Chemistry Program and the BWR Penetrations Program, plus examination of other components with the same material/environments by the ISI program, and 3) state that PNPS will continue to follow BWRVIP-27 guidelines during the period of extended operation, including examinations in excess of code requirements. The project team determined that the applicant's BWR Penetrations Program includes the appropriate components within its scope and that for these components the program provides both mitigation of aging effects and examinations to confirm the effectiveness of the mitigation during the period of extended operation. On this basis, the project team found this exception acceptable.

<u>Exception 2</u>

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Element: 3: Parameters Monitored/Inspected
Exception: Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda.

The GALL Report identified the following recommendation for the "Parameters Monitored/Inspected" program element associated with the exception taken:

> The program monitors the effects of SCC/IGSCC on the intended function of the component by detection and sizing of cracks by ISI in accordance with the guidelines of approved BWRVIP-49 or BWRVIP-27 and the requirements of the ASME Code, Section XI, Table IWB 2500-1 (2001 edition including the 2002 and 2003 Addenda). An applicant may use the guidelines of BWRVIP-62 for inspection relief for vessel internal components with hydrogen water chemistry, provided that such relief is submitted under the provisions of 10 CFR 50.55a and approved by the staff.

The applicant stated, in the PNPS LRA, that since ASME Section XI through the 2003 Addenda has been accepted by reference in 10 CFR 50.55a paragraph (b) (2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.



During the audit and review, the project team asked the applicant to compare the examination recommendations of BWRVIP-49 and ASME Section XI, Table IWB-2500-1 with the examinations implemented by their BWR Penetrations Program. In response to this question, the applicant stated that BWRVIP-49 recommends that surface examinations be performed per ASME XI, IWB-2500, Category B-F requirements; however, Class 1 Category B-F and B-J welds at PNPS are inspected in accordance with the PNPS ISI program. The applicant stated that this program selects welds for examination based on a combined risk ranking that considers the risk of failure and the consequences of such a failure. The applicant stated that this program selected one weld out of the four welds at the N16A and B nozzle for inspection. The applicant stated that the weld was ultrasonically examined during refueling outage 15 (RFO15) in 2005 with no indications detected.

The project team asked the applicant to provide a comparison of the number of Category B-F weld inspections and category B-J weld inspections before and after implementation of risk-informed (RI) selection criteria in their ISI program. In response to this question, the applicant provided the following information:

> Code Category B-F:
> There are a total of 40 B-F welds in the ISI program. Before RI-ISI implementation, there were 40 weld exams; and after RI-ISI, there are now 11 welds examined.
>
> Code Category B-J:
> There are a total of 598 B-J welds in the ISI program. Before RI-ISI implementation, there

were 156 weld exams [25 percent of the total]; and after RI-ISI, there are now 60 welds examined.

In addition to ISI program welds, there are augmented IGSCC BWRVIP-75A program welds examined. For the IGSCC category B thru G welds examined per BWRVIP-75A, there are 16 category B-F welds and 18 category B-J welds.

The project team reviewed the applicant's responses, together with the applicant's fourth 10-year inspection program plan (ML051920157) and confirmed that the applicant's use of ASME Section XI, 1998 edition with 2000 addenda as the basis for their BWR Penetrations Program is consistent with the applicant's fourth ten-year inspection program plan. The project team also determined, based on the applicant's responses, that with implementation of RI selection criteria, the applicant's ISI program continues to provide examination of a substantial representative population from all weld examination categories applicable at PNPS.

During the audit and review, the project team asked the applicant to provide a comparison of the number, type, frequency, and extent of inspections required for instrument penetration nozzles N15A/B and N16A/B before implementation of RI-ISI and after implementation of RI-ISI. In response to this request, the applicant provided an appropriate tabulation of N15A/B and N16A/B penetration nozzle inspection history. For the N15A/B penetration nozzles, the tabulated results indicated that before RI-ISI implementation, the code-required VT-2 examination was performed every refueling outage and that after RI-ISI implementation, the enhanced VT-2 examination, which is in excess of code requirements, has been performed. For the N15A/B penetration nozzles, both before and after RI-ISI implementation, there were no adverse examination findings. For the N16A/B penetration nozzles, there are two welds per nozzle subject to examination. Before RI-ISI implementation, a PT (penetrant testing) surface examination was performed on each weld once during each 10-year ISI inspection interval; in addition, the code-required VT-2 examination of each penetration nozzle was performed every refueling outage. After RI-ISI implementation, an enhanced VT-2 examination of each nozzle penetration is performed at each refueling outage; however, a PT surface examination is performed on only one weld, the N16B-2, once during each 10-year ISI inspection interval. In addition, after RI-ISI implementation, a UT examination of the N16B-2 nozzle safe end to reducer weld is performed once every 10 years. For the N16A/B penetration nozzles, both before and after RI-ISI implementation, there were no adverse examination findings.

On the basis that PNPS implementation of RI-ISI has not resulted in eliminating code-required examinations for any weld category and that a number of welds of the same material in a similar environment will continue to be inspected, the project team found the applicant's response to be acceptable. On this basis, the project team found this exception acceptable.

3.0.3.2.4.4 Enhancements

None.

3.0.3.2.4.5 Operating Experience

The applicant stated, in the PNPS LRA, that in January 2005, three 2½" piping butt welds in SLC system piping adjacent to nozzle N14 were found to be unidentified on inspection drawings and not included in ISI weld population totals. Two of the welds (RPV-N14-T1 and RPV-N14-T2) are shop welds in a vendor supplied tee. The third weld (RPV-14-2) is the connection field weld between the tee and the SLC nozzle (N14) safe end extension piece. This weld was included in surface examinations of the N14 nozzle safe end weld and safe end extension piece performed in RFO11. Corrective actions included adding the welds to ISI weld population totals and performing a nozzle surface examination of weld RPV-N14-2 during RFO15. Since RPV-N14-2 has been examined without recordable indications, and will continue to be examined as required, this programmatic error did not impact the ability of the BWR Penetrations Program to manage the effect of cracking on the intended function of the SLC nozzle.

Inservice examination of the SLC nozzle, (including weld RPV-N14-2 as discussed above), during RFO15 (April 2005) resulted in no recordable indications. Absence of recordable indications on the SLC nozzle and adjacent welds provides evidence that the program is effective for managing cracking of the nozzle.

Liquid penetrant examination of instrument penetration nozzle N15A in 1990 resulted in no recordable indications. Absence of recordable indications on the instrument nozzles provides evidence that the program is effective for managing cracking of the instrument penetration nozzles.



Inservice examination of instrument penetration nozzles during RFO15 (April 2005) resulted in no recordable indications. Absence of recordable indications on the instrument nozzles provides evidence that the program is effective for managing cracking of the nozzles.

During the audit and review, the project team asked the applicant to explain the apparent inconsistency that weld RPV-N14-2 was not included in the ISI weld population until RFO15, yet it was included in the surface examinations of the N14 nozzle safe end weld and safe end extension piece during RFO11. In response to this request, the applicant provided the following information:

> GE service information letter (SIL) 571 recommends that surface examinations be performed on small bore nozzle safe end extensions fabricated from 304 stainless steel. The SIL recommends that the entire safe end extension piece including the nozzle to safe end weld receive a surface examination. The fabrication of the nozzle and safe end extension assembly includes line boring of the nozzle/safe end extension assembly inner surfaces and machining of the outside surface to a flush condition. The extensive cold working during fabrication can sensitize the austenitic stainless steel extension piece such that IGSCC could occur in the base metal of the safe end extension as well as the weld heat affected zones. This machining also prevents the nozzle to safe end weld transition from being easily detected by an inspector. To ensure that the entire nozzle to safe end extension piece and the nozzle to safe end weld were examined in RFO11, ISI NDE inspectors were instructed by PNPS to perform a surface examination of the entire nozzle and safe end extension piece from the RPV outside wall out to the adjacent tee. As a result of the conservative approach, the RPV-N14-2 weld was included by default in the surface

examination boundary.

On the basis that the applicant's response provides a reasonable explanation of the apparent discrepancy, the project team found the applicant's response acceptable.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the BWR Penetrations Program and did not find any evidence of PNPS equipment degradation or failures that are outside the envelope of 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 concluded that the applicant's BWR Penetrations Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.4.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the BWR Penetrations Program in PNPS LRA, Appendix A, Section A.2.1.5, which states that the BWR Penetrations Program includes (a) inspection and flaw evaluation in conformance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) documents BWRVIP-27 and BWRVIP-49 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel penetrations and nozzles.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.5, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.4.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 BWR STRESS CORROSION CRACKING PROGRAM (PNPS AMP B.1.6)

In PNPS LRA, Appendix B, Section B.1.6,, the applicant stated that PNPS AMP B.1.6, "BWR

Stress Corrosion Cracking Program," is an existing plant program that is consistent with GALL AMP XI.M7, "BWR Stress Corrosion Cracking," with an exception and an enhancement.

3.0.3.2.5.1 Program Description

The applicant stated, in the PNPS LRA, that this program includes (a) preventive measures to mitigate IGSCC, and (b) inspection and flaw evaluation to monitor IGSCC and its effects on reactor coolant pressure boundary components made of stainless steel or CASS.

3.0.3.2.5.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.6 is consistent with GALL AMP XI.M7, 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 audit and review report for PNPS AMP B.1.6, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.5, "BWR Stress Corrosion Cracking Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M7. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.6 and associated bases documents to determine consistency with GALL AMP XI.M7.

The project team also reviewed PNPS Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.5, "BWR Stress Corrosion Cracking Program," Generic Letter 88-01, NRC Position on IGSCC in BWR Austinetic Stainless Steel Piping; Generic Letter 88-01, Supplement 1; and ASME Section XI, 1998 edition with 2000 addenda, Subsection IWB-3600, "Analytical Evaluation of Flaws."

The project team reviewed those portions of the BWR Stress Corrosion Cracking Program for which the applicant claims consistency with GALL AMP XI.M7 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's BWR Stress Corrosion Cracking Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's BWR Stress Corrosion Cracking Program acceptable because it conforms to the recommended GALL AMP XI.M7, "BWR Stress Corrosion Cracking," with the exception and enhancement as described below.

3.0.3.2.5.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

Element: 6: Acceptance Criteria
Exception: The 1998 edition with 2000 addenda of ASME Section XI, Subsection IWB-3600 is used for flaw evaluation, while NUREG-1801 specifies the 1986

edition of ASME Section XI, Subsection IWB-3600 for flaw evaluation.

The GALL Report identified the following recommendation for the "Acceptance Criteria" program element associated with the exception taken:

> As recommended in NRC GL 88-01, any indication detected is evaluated in accordance with ASME Section XI, IWB-3600 of Section XI of the 1986 Edition of the ASME Boiler and Pressure Vessel Code and the guidelines of NUREG-0313.
>
> Applicable and approved BWRVIP-14, BWRVIP-59, BWRVIP-60, and BWRVIP-62 documents provide guidelines for evaluation of crack growth in SSs, nickel alloys, and low-alloy steels. An applicant may use BWRVIP-61 guidelines for BWR vessel and internals induction heating stress improvement effectiveness on crack growth in operating plants.

The applicant stated, in the PNPS LRA, that since ASME Section XI through the 2003 Addenda has been accepted by NRC in 10 CFR 50.55a paragraph (b)(2) without modification or limitation on use of Subsection IWB-3600 from the 1998 edition with 2000 addenda, use of this version for flaw evaluation is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.



During the audit and review, the project team asked the applicant to identify which specific paragraphs of subsection IWB-3600, Analytical Evaluation of Flaws, are different between the 1986 edition of ASME Section XI identified in the GALL Report and the 1998 edition with 2000 addenda of ASME Section XI used by the applicant's program. In response to this request, the applicant provided a comparison table listing the changes in Subsection IWB-3600 between the requested editions of ASME Section XI. The project team reviewed the applicant's response together with Generic Letter (GL) 88-01, NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping issued January 25, 1988, and GL 88-01, Supplement 1, issued February 4, 1992. On the basis of this review, the project team determined that the reference to the 1986 code edition in GL 88-01 is a reference to the approved ASME Section XI edition at the time that GL 88-01 was issued and that neither the original generic letter nor its later supplement include a requirement that analytical evaluation of flaws be performed in accordance with only the 1986 code edition, and not a later edition that has been accepted by the NRC. Because there is no specific requirement that the 1986 code edition and no other be used, and because ASME Section XI, the 1998 edition with 2000 addenda, has been accepted by the NRC without modification or limitation on use of subsection IWB-3600, the project team determined that the applicant's use of Subsection IWB-3600 of ASME Section XI, the 1998 edition with 2000 addenda, for analytical evaluation of flaws is acceptable. On this basis, the project team found this exception acceptable.

3.0.3.2.5.4 Enhancements

The applicant stated, in the PNPS LRA, that the enhancement in meeting the GALL Report program element is as follows:

Element: 5: Monitoring and Trending
Enhancement: The implementing procedure for ASME Section XI inservice inspection and testing will be enhanced to specify that the guidelines of Generic Letter 88-01 or approved BWRVIP-75 shall be considered in determining sample expansion if indications are found in Generic Letter 88-01 welds.

The GALL Report identified the following recommendation for the "Monitoring and Trending" program element associated with the enhancement:

> The extent and schedule for inspection, in accordance with the recommendations of NRC GL 88-01 or approved BWRVIP-75 guidelines, provide timely detection of cracks and leakage of coolant. Based on inspection results, NRC GL 88-01 or approved BWRVIP-75 guidelines provide guidelines for additional samples of welds to be inspected when one or more cracked welds are found in a weld category.

The applicant stated, in the PNPS LRA, that this enhancement will be initiated prior to the period of extended operation.

During the audit and review, the project team observed that the LRA describes this and other enhancements as "initiated" prior to the period of extended operation. The project team noted that in describing an enhancement as something to be "initiated" rather than "implemented," the LRA wording is ambiguous with regard to whether the enhancement will be fully implemented prior to the period of extended operation. The project team asked the applicant to clarify or resolve the ambiguity in the LRA's descriptions of enhancements. In its letter dated **mm-dd-yyyy (MLxxxxxxxxxx)**, the applicant stated that the intent of saying that enhancements will be initiated prior to the period of extended operation is that the enhancements will be fully implemented prior to the period of extended operation. **{OPEN ITEM}**. Since this response provided the clarification requested, the project found it to be acceptable.

During the audit and review, the project team asked the applicant to clarify PNPS' current basis for determining sample expansion if indications are found in GL 88-01 welds. In response to this request, the applicant provided the following information:

> If cracking is determined in GL 88-01 Category A welds, the scope expansion rules of the PNPS Risk-Informed ISI Program in accordance with EPRI Topical Report TR-112657 will be used to determine scope expansion size and content. Scope expansion caused by cracking detected in any other GL 88-01 category (B through G) will be determined by the scope expansion criteria of BWRVIP-75A used in conjunction with GL 88-01.

Since the applicant uses appropriate basis for determining sample expansion if indications are found in GL 88-01 welds, the project team found the applicant's response to be acceptable.

The project team reviewed the applicant's evaluation of the monitoring and trending element of their current BWR Stress Corrosion Cracking Program, documented in the PNPS Aging Management Program Evaluation Report, which stated that the applicable section of their implementing procedure for ASME code inservice inspection and inservice testing will be enhanced to specify that the guidelines in Generic Letter 88-01 or approved BWRVIP-75 shall be considered in determining sample expansions if indications are found in Generic Letter 88-01 welds. The project team reviewed the applicable implementing procedure section and found that the current procedure states that PNPS design engineering is to determine sample expansion if ASME Section XI does not specify the expansion sample; the current procedure does not provide a specific reference to GL 88-01 or BWRVIP-75 requirements. On the basis that the GALL Report states that NRC GL 88-01 or approved BWRVIP-75 guidelines provide guidelines for additional samples of welds to be inspected when one or more cracked welds are found in a weld category, the project team has determined that the applicant's enhancement to add references to NRC GL 88-01 and BWRVIP-75 into the implementing procedure is needed to bring the current program into conformance with the GALL Report recommendations and is acceptable.

On this basis, the project team found this enhancement acceptable since when enhancement is implemented, PNPS AMP B.1.6, "BWR Stress Corrosion Cracking Program," will be consistent with GALL AMP XI.M7 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.2.5.5 <u>Operating Experience</u>

The applicant stated, in the PNPS LRA, that ultrasonic examinations of GL 88-01 nozzle safe end welds and austenitic stainless steel reactor coolant piping with 4" and greater nominal diameter and operating temperature greater than 200°F during RFO14 (April 2003) resulted in no recordable indications. Absence of recordable indications on the nozzles and piping provides evidence that the program is effective for managing cracking of austenitic stainless steel components.

Ultrasonic examinations of nozzle safe end welds and austenitic stainless steel reactor coolant piping with 4" and greater nominal diameter and operating temperature greater than 200°F during RFO15 (April 2005) resulted in no recordable indications. Absence of recordable indications on the nozzles and piping provides evidence that the program is effective for managing cracking of the nozzles and piping.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the BWR Stress Corrosion Cracking Program and did not find any evidence of PNPS component degradation or failures that are outside the envelope of 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 concluded that the applicant's BWR Stress Corrosion Cracking Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.5.6 <u>UFSAR Supplement</u>

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The applicant provided its UFSAR Supplement for the BWR Stress Corrosion Cracking Program PNPS LRA, Appendix A, Section A.2.1.6, which states that the BWR Stress Corrosion Program includes (1) preventive measures to mitigate IGSCC and (2) inspection and flaw evaluation to monitor IGSCC and its effects on reactor coolant pressure boundary components made of stainless steel or CASS.

PNPS has taken actions to prevent IGSCC and will continue to use materials resistant to IGSCC for component replacements and repairs following the recommendations delineated in NUREG-0313, Generic Letter 88-01, and the staff-approved BWRVIP-75 report. Inspection of piping identified in NRC Generic Letter 88-01 to detect and size cracks is performed in accordance with the staff positions on schedule, method, personnel qualification, and sample expansion included in the generic letter and the staff-approved BWRVIP-75 report.

During the audit and review, the project team noted that the applicant's description of the BWR Stress Corrosion Cracking Program in the UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the enhancement described in LRA, Appendix B.1.6, BWR Stress Corrosion Cracking. The project team asked the applicant to include a description of the enhancement to PNPS' BWR Stress Corrosion Cracking Program in the UFSAR Supplement in LRA, Appendix A. In response to this request, the applicant stated that the program description in Appendix A will be revised to identify the commitment number associated with the enhancement for the BWR Stress Corrosion Cracking Program as described in LRA Appendix B. The program description in Appendix A will be amended to include the following statement:

> License renewal commitment number 2 specifies an enhancement to this program.

This will require an amendment to the license renewal application. **{OPEN ITEM}**

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.6, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.5.7 <u>Conclusion</u>

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 <u>BWR VESSEL ID ATTACHMENT WELDS PROGRAM (PNPS AMP B.1.7)</u>

In PNPS LRA, Appendix B, Section B.1.7, the applicant stated that PNPS AMP B.1.7, "BWR Vessel ID Attachment Welds Program," is an existing plant program that is consistent with GALL AMP XI.M4, "BWR Vessel ID Attachment Welds," with an exception.

3.0.3.2.6.1 <u>Program Description</u>

The applicant stated, in the PNPS LRA, that this program includes (a) inspection and flaw evaluation in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) BWRVIP-48 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 (EPRI Report 1008192) to ensure the long-term integrity and safe operation of reactor vessel inside diameter (ID) attachment welds and support pads.

3.0.3.2.6.2 <u>Consistency with the GALL Report</u>

In the PNPS LRA, the applicant stated that PNPS AMP B.1.7 is consistent with GALL AMP XI.M4, 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 audit and review report for PNPS AMP B.1.7, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.4, "BWR Vessel ID Attachment Welds Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M4. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.7 and associated bases documents to determine consistency with GALL AMP XI.M4.

The project team also reviewed PNPS Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.6, "BWR Vessel ID Attachment Welds Program;" PNPS-RPT-05-001, Revision 0, "Fourth 10-Year ISI Program Plan" (ML051920157); and BWRVIP-48, "Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines," February 1998.

The project team reviewed those portions of the BWR Vessel ID Attachment Welds Program for which the applicant claims consistency with GALL AMP XI.M4 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's BWR Vessel ID Attachment Welds Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. The project team found the applicant's BWR Vessel ID Attachment Welds Program acceptable because it conforms to the recommended GALL AMP XI.M4, "BWR Vessel ID Attachment Welds," with the exception as described below.

3.0.3.2.6.3 <u>Exceptions to the GALL Report</u>

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

<u>Exception</u>

Element: 3: Parameters Monitored/Inspected
Exception: Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda.

The GALL Report identified the following recommendation for the "Parameters Monitored/Inspected" program element associated with the exception taken:

> The program monitors the effects of SCC and IGSCC on the intended function of vessel attachment welds by detection and sizing of cracks by ISI in accordance with the guidelines of approved BWRVIP-48 and the requirements of the ASME Code, Section XI, Table IWB 2500-1 (2001 edition including the 2002 and 2003 Addenda). An applicant may use the guidelines of BWRVIP-62 for inspection relief for vessel internal components with hydrogen water chemistry provided that such relief is submitted under the provisions of 10 CFR 50.55a and approved by the staff.

The applicant stated, in the PNPS LRA, that since ASME Section XI through the 2003 Addenda has been accepted by reference in 10 CFR 50.55a paragraph (b)(2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

During the audit and review, the project team asked the applicant to confirm that PNPS performs the more stringent inspections of applicable vessel ID attachment welds as recommended in BWRVIP-48 and described in the GALL Report, Section XI.M4, BWR Vessel ID Attachment Welds Program, "Detection of Aging Effects" program element. The project team also asked the applicant to provide a list of the Category B-N-2 vessel ID attachment welds that are inspected using the more stringent enhanced VT-1 examination techniques. In response to these requests, the applicant provided the following information:

> PNPS follows the requirement of BWRVIP-48 as approved by the NRC for inspections. The components that are inspected using the enhanced VT-1 techniques recommended in BWRVIP-48 are 1) jet pump riser brace - primary brace attachments, 2) core spray piping - primary bracket attachments, 3) steam dryer support brackets, and 4) feedwater bracket attachments.

The project team reviewed the applicant's response together with the inspection recommendations in BWRVIP-48. Based on this review, the project team determined that the attachment welds listed by the applicant as subject to the enhanced VT-1 examination technique are the same welds for which the modified ("enhanced") VT-1 examination technique is recommended in BWRVIP-48, Table 3-2, Bracket Attachment Inspection Recommendations.

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Based on consistency between the components listed in the applicant's response and the components listed in BWRVIP-48, the project team found the applicant's response acceptable.

During the audit and review, the project team asked the applicant to confirm that the PNPS BWR Vessel ID Attachment Welds Program implements the evaluation guidelines of BWRVIP-14, BWRVIP-59, and BWRVIP-60, which are listed in the GALL Report's description of the "Acceptance Criteria" program element for the BWR Vessel ID Attachment Welds Program. In response to this request, the applicant provided the following statement:

> PNPS plant procedures require that flaws be evaluated in accordance with BWRVIP Inspection and Flaw Evaluation Guidelines for components that perform a safety function. Subsequent BWRVIP correspondence that has been approved by the BWRVIP Executive Committee must also be considered when evaluating flaws. For components that do not perform a safety function, flaw evaluation shall be established by Design Engineering using the Condition Report process. Any flaw evaluation done by PNPS would consider all pertinent information available at that time, including the three BWRVIP documents listed in NUREG-1801, Section XI.M4.

Because the PNPS flaw evaluation process includes the BWRVIP evaluation guidelines recommended in the GALL Report, the project team found the applicant's response acceptable.

The project team reviewed the applicant's responses together with the applicant's fourth 10-year inservice inspection program plan (ML051920157) and confirmed that the applicant's use of ASME Section XI, 1998 edition with 2000 addenda, as the basis for their BWR Vessel ID Attachment Welds Program is consistent with the applicant's fourth 10-year inspection program plan. The project team also determined on the basis of the applicant's responses that the PNPS BWR Vessel ID Attachment Welds Program is consistent with recommendations of the GALL Report and the BWRVIP reports referenced therein for other program elements. On this basis, the project team found this exception acceptable.

3.0.3.2.6.4 Enhancements

None.

3.0.3.2.6.5 Operating Experience

The applicant stated, in the PNPS LRA, that visual and enhanced visual examinations of vessel attachment welds (feedwater bracket attachment and jet pump riser braces) during RFO14 (April 2003) resulted in no recordable indications. Previous visual and enhanced visual examinations of vessel attachment welds resulted in no recordable indications. Absence of recordable indications on the vessel attachment welds provides evidence that the program is effective for managing cracking of the welds.

Visual and enhanced visual examinations of vessel attachment welds (core spray piping bracket, guide rod bracket attachment, steam dryer support brackets, steam dryer hold-down brackets, and surveillance specimen holder brackets) during RFO15 (April 2005) resulted in no recordable indications. Absence of recordable indications on the vessel attachment welds provides evidence that the program is effective for managing cracking of the welds.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the BWR Vessel ID Attachment Welds Program and did not find any evidence of PNPS component degradation or failures that are outside the envelope of 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 concluded that the applicant's BWR Vessel ID Attachment Welds Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.6.6 UFSAR Supplement

The applicant provided its UFAR Supplement for the BWR Vessel ID Attachment Welds Program in PNPS LRA, Appendix A, Section A.2.1.7, which states that the BWR Vessel ID Attachment Welds Program includes (1) inspection and flaw evaluation in accordance with the guidelines of staff-approved BWR Vessel and Internals Project (BWRVIP) BWRVIP-48, and (2) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity and safe operation of reactor vessel inside diameter (ID) attachment welds and support pads.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.7, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.6.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 BWR VESSEL INTERNALS PROGRAM (PNPS AMP B.1.8)

In PNPS LRA, Appendix B, Section B.1.8, the applicant stated that PNPS AMP B.1.8, "BWR Vessels Internals Program," is an existing plant program that is consistent with GALL

AMP XI.M9, "BWR Vessels Internals," with exceptions and an enhancement.

3.0.3.2.7.1 Program Description

The applicant stated, in the PNPS LRA, that this program includes (a) inspection, flaw evaluation, and repair in conformance with the applicable, staff-approved BWR reactor vessel and internals project (BWRVIP) documents, and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel internals components.

3.0.3.2.7.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.8 is consistent with GALL AMP XI.M9, with exceptions 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 audit and review report for PNPS AMP B.1.8, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.7, "BWR Vessel Internals Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M9. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.8 and associated bases documents to determine consistency with GALL AMP XI.M9.

The project team also reviewed PNPS Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.7, "BWR Vessel Internals Program;" BWRVIP-42, BWR LPCI Coupling Flaw Inspection and Flaw Evaluation Guidelines, December 1997; BWRVIP-26, BWR Top Guide Inspection and Flaw Evaluation Guidelines, December 1996; PNPS Calculation Number M-1017, Revision 0, "Top Guide Weld and Hold Down Assembly Inspection Evaluation;" PNPS-NE21.01, Revision 5, "Reactor Vessel Internals Inspection Implementing Procedure;" PNPS-EP-06-0001, Rev. 0, Entergy Nuclear, Engineering Report, "Reactor Vessel Internals Inspection Program;" BWRVIP-18, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines, July 1996; BWRVIP-41, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines, October 1997; PNPS-RPT-05-001, Revision 0, "Fourth 10-Year ISI Program Plan" (ML051920157); PNPS UFSAR Section 3.3.4.1.1, Core Shroud; BWRVIP-25, BWR Core Plate Inspection and Flaw Evaluation Guidelines, December 1996.

The project team reviewed those portions of the BWR Vessel Internals Program for which the applicant claims consistency with GALL AMP XI.M9 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's BWR Vessel Internals Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's BWR Vessel Internals Program acceptable because it conforms to the recommended GALL AMP XI.M9, "BWR Vessel Internals," with the exceptions and enhancement as described below.

3.0.3.2.7.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exceptions to the GALL Report program elements are as follows:

Exception 1

Elements: 1: Scope of Program
4: Detection of Aging Effects
Exception: **Low Pressure Coolant Injection (LPCI) Coupling:** BWRVIP-42 guidelines are not applicable to PNPS.

The GALL Report identified the following recommendations for the "Scope of Program" and "Detection of Aging Effects" program elements associated with the exception taken:

**Scope of Program:** The program is focused on managing the effects of cracking due to SCC, IGSCC, or irradiation-assisted stress corrosion cracking (IASCC). The program contains preventive measures to mitigate SCC, IGSCC, or IASCC; inservice inspection (ISI) to monitor the effects of cracking on the intended function of the components; and repair and/or replacement as needed to maintain the ability to perform the intended function of BWR vessel internals.

The BWRVIP documents provide generic guidelines intended to present the applicable inspection recommendations to assure safety function integrity of the subject safety-related reactor pressure vessel internal components. The guidelines include information on component description and function; evaluate susceptible locations and safety consequences of failure; provide recommendations for methods, extent, and frequency of inspection; discuss acceptable methods for evaluating the structural integrity significance of flaws detected during these examinations; and recommend repair and replacement procedures.

The various applicable BWRVIP guidelines are as follows:

*Core shroud*: BWRVIPs-07, -63, and -76 provide guidelines for inspection and evaluation; BWRVIP-02, Rev. 2, provides guidelines for repair design criteria.

*Core plate*: BWRVIP-25 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria.

*Shroud support*: BWRVIP-38 provides guidelines for inspection and evaluation; BWRVIP-52 provides guidelines for repair design criteria.

*Low-pressure coolant injection (LPCI) coupling*: BWRVIP-42 provides guidelines for inspection and evaluation; BWRVIP-56 provides guidelines for repair design criteria.

*Top guide:* BWRVIP-26 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria. Additionally, for top guides with neutron fluence exceeding the IASCC threshold (5E20, E>lMeV) prior to the period of extended operation, inspect five percent (5%) of the top guide locations using enhanced visual inspection technique, EVT-1 within six years after entering the period of extended operation.

An additional 5 percent of the top guide locations will be inspected within 12 years after entering the period of extended operation. Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5 percent of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5 percent of the top guide locations will be inspected within 12 years after the date projected for exceeding the threshold. The top guide inspection locations are those that have high neutron fluences exceeding the IASCC threshold. The extent of the examination and its frequency will be based on a 10-percent sample of the total population, which includes all grid beam and beam-to-beam crevice slots.

*Core spray*: BWRVIP-18 provides guidelines for inspection and evaluation; BWRVIP-16 and 19 provides guidelines for replacement and repair design criteria, respectively.

*Jet pump assembly*: BWRVIP-41 provides guidelines for inspection and evaluation; BWRVIP-51 provides guidelines for repair design criteria.

*Control rod drive (CRD) housing*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-58 provides guidelines for repair design criteria.



*Lower plenum*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-57 provides guidelines for repair design criteria for instrument penetrations. In addition, BWRVIP-44 provides guidelines for weld repair of nickel alloys; BWRVIP-45 provides guidelines for weldability of irradiated structural components.

**Detection of Aging Effects:** The extent and schedule of the inspection and test techniques prescribed by the applicable and approved BWRVIP guidelines are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of BWR vessel internals. Inspection can reveal cracking. Vessel internal components are inspected in accordance with the requirements of ASME Section XI, Subsection IWB, examination category B-N-2. The ASME Section XI inspection specifies visual VT-1 examination to detect discontinuities and imperfections, such as cracks, corrosion, wear, or erosion, on the surfaces of components. This inspection also specifies visual VT-3 examination to determine the general mechanical and structural condition of the component supports by (a) verifying parameters, such as clearances, settings, and physical displacements, and (b) detecting discontinuities and imperfections, such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion.

The applicable and approved BWRVIP guidelines recommend more stringent inspections, such as enhanced visual VT-1 examinations or ultrasonic methods of volumetric inspection, for certain selected components and locations. The nondestructive examination (NDE) techniques appropriate for inspection of BWR vessel internals including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03.

The applicant stated, in the PNPS LRA, that Exception 1, affecting inspection of the LPCI coupling, is acceptable because BWRVIP-42 provides guidelines for inspection and evaluation of the LPCI and PNPS has no LPCI coupling.

During the audit and review, the project team reviewed BWRVIP-42 together with applicable PNPS piping diagrams. On the basis of this review, the project team determined that the LPCI coupling is a feature of new BWR/4, BWR/5, and BWR/6 plants; and that PNPS is an earlier BWR/3 plant which does not have a LPCI coupling. On the basis that PNPS does not have a LPCI coupling, the project team found Exception 1 to the BWR Vessel Internals Program as described in the GALL Report to be acceptable.

<u>Exception 2</u>

Elements: 1: Scope of Program
4: Detection of Aging Effects

Exception: **Top Guide:** Inspections of the four top guide hold-down assemblies and four guide aligner assemblies is not performed at PNPS. The top guide rim weld does not exist at PNPS and is therefore exempt.

The GALL Report identified the following recommendations for the "Scope of Program" and "Detection of Aging Effects" program elements associated with the exception taken:

**Scope of Program:** The program is focused on managing the effects of cracking due to SCC, IGSCC, or IASCC. The program contains preventive measures to mitigate SCC, IGSCC, or IASCC; ISI to monitor the effects of cracking on the intended function of the components; and repair and/or replacement as needed to maintain the ability to perform the intended function of BWR vessel internals.

The BWRVIP documents provide generic guidelines intended to present the applicable inspection recommendations to assure safety function integrity of the subject safety-related reactor pressure vessel internal components. The guidelines include information on component description and function; evaluate susceptible locations and safety consequences of failure; provide recommendations for methods, extent, and frequency of inspection; discuss acceptable methods for evaluating the structural integrity significance of flaws detected during these examinations; and recommend repair and replacement procedures.

The various applicable BWRVIP guidelines are as follows:

*Core shroud*: BWRVIPs-07, -63, and -76 provide guidelines for inspection and evaluation; BWRVIP-02, Rev. 2, provides guidelines for repair design criteria.

*Core plate*: BWRVIP-25 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria.

*Shroud support*: BWRVIP-38 provides guidelines for inspection and evaluation; BWRVIP-52 provides guidelines for repair design criteria.

*Low-pressure coolant injection (LPCI) coupling*: BWRVIP-42 provides guidelines for inspection and evaluation; BWRVIP-56 provides guidelines for repair design criteria.

*Top guide:* BWRVIP-26 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria. Additionally, for top guides with neutron fluence exceeding the IASCC threshold (5E20, E>lMeV) prior to the period of extended operation, inspect five percent (5%) of the top guide locations using enhanced visual inspection technique, EVT-1 within six years after entering the period of extended operation.

An additional 5 percent of the top guide locations will be inspected within 12 years after entering the period of extended operation. Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5 percent of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5 percent of the top guide locations will be inspected within 12 years after the date projected for exceeding the threshold. The top guide inspection locations are those that have high neutron fluences exceeding the IASCC threshold. The extent of the examination and its frequency will be based on a 10-percent sample of the total population, which includes all grid beam and beam-to-beam crevice slots.

*Core spray*: BWRVIP-18 provides guidelines for inspection and evaluation; BWRVIP-16 and 19 provides guidelines for replacement and repair design criteria, respectively.

*Jet pump assembly*: BWRVIP-41 provides guidelines for inspection and evaluation; BWRVIP-51 provides guidelines for repair design criteria.

*Control rod drive (CRD) housing*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-58 provides guidelines for repair design criteria.

*Lower plenum*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-57 provides guidelines for repair design criteria for instrument penetrations. In addition, BWRVIP-44 provides guidelines for weld repair of nickel alloys; BWRVIP-45 provides guidelines for weldability of irradiated structural components.

**Detection of Aging Effects:** The extent and schedule of the inspection and test techniques prescribed by the applicable and approved BWRVIP guidelines are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of BWR vessel internals. Inspection can reveal cracking. Vessel internal components are inspected in accordance with the requirements of ASME Section XI, Subsection IWB, examination category B-N-2. The ASME Section XI inspection specifies visual VT-1 examination to detect discontinuities and imperfections, such as cracks, corrosion, wear, or erosion, on the surfaces of components. This inspection also specifies visual VT-3 examination to determine the general mechanical and structural condition of the component supports by (a) verifying parameters, such as clearances, settings, and physical displacements, and (b) detecting discontinuities and imperfections, such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion.

The applicable and approved BWRVIP guidelines recommend more stringent inspections, such as enhanced visual VT-1 examinations or ultrasonic methods of volumetric inspection, for certain selected components and locations. The nondestructive examination (NDE) techniques appropriate for inspection of BWR vessel internals including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03.

The applicant stated in the PNPS LRA that Exception 2, affecting inspection of the top guide, is acceptable because PNPS has a plant-specific analysis to account for plant-specific dynamic loading of the top guide hold-down and aligner assemblies, which concludes that less than 20 percent of the weld area on the top guide hold-down and aligner assemblies is needed to resist load; and therefore, in accordance with Table 3-2 of BWRVIP-26, inspection of the four top guide hold-down assemblies and four top guide aligner assemblies is not performed at PNPS.

During the audit and review, the project team asked the applicant to provide a technical basis to support the LRA's statement that inspection of the four top guide hold-down assemblies and four top guide aligners is not required if 20 percent or less of the weld area is sufficient to resist loads from the top guide during faulted events. In response to this request, the applicant referred to BWRVIP-26, Table 3-2, Matrix of Inspection Options, examination locations (2,3), aligner pins and sockets in the top guide and shroud, and examination location (8), hold down assemblies. The applicant noted that, with regard to inspection of the aligner pins and sockets, BWRVIP-26 states that if an analysis of plant-specific dynamic loading has determined that less than 20 percent of the weld is required, no inspection is needed. The applicant noted that, with regard to inspection of the hold down assemblies, BWRVIP-26 recommends a VT-1 inspection only for plants whose faulted vertical loads exceed the top guide weight. The applicant provided a copy of the plant-specific evaluation that shows less than 20 percent of the weld area is sufficient to resist loads from the top guide during faulted events. In addition, the applicant stated that BWRVIP-26, Figure A-1, Evaluation of Need for Hold Down Devices, includes a data point for the PNPS top guide, and the plant-specific data show that vertical loads during a faulted event do not exceed the weight of the PNPS top guide. The project team reviewed applicable sections of BWRVIP-26 and the plant-specific evaluations. Based on these reviews, the project team determined that PNPS has completed appropriate plant-specific evaluations consistent with the BWRVIP-26 recommendations so that inspections of the PNPS top guide hold down assemblies and top guide aligners are not required. On this basis, the project team found the applicant's response to be acceptable.

During the audit and review, the project team asked the applicant to further discuss the LRA's statement that the top guide rim weld does not exist at PNPS. Specifically, the project team asked the applicant to clarify whether the top guide rim weld does not exist at PNPS or whether the top guide rim weld is assumed to be fully cracked. Furthermore, if the rim weld has never existed at PNPS, the project team asked the applicant to discuss how the bottom plate of the top guide is attached to the rim of the top guide. In response to this request, the applicant provided the following information:

**{RESPONSE TO NEWQUESTION B.1.8-J-09GOES HERE}**

On the basis that **{??????–reponse needed to complete this writeup}** the project team found the applicant's response to be acceptable.

Based upon the project teams questions and acceptability of the applicant's responses as described above, the project team found Exception 2 to the BWR Vessel Internals Program as described in the GALL Report to be acceptable.

Exception 3

Elements: 1: Scope of Program
4: Detection of Aging Effects

Exception: **Core Spray:** PNPS defers inspection of three inaccessible welds inside each of the two core spray nozzles until a delivery system for ultrasonic testing of the hidden welds is developed. Thus, PNPS does not meet the BWRVIP-18 requirement to perform an ultrasonic inspection of a full target weld set every other refueling outage.



The GALL Report identified the following recommendations for the "Scope of Program" and "Detection of Aging Effects" program elements associated with the exceptions taken:

**Scope of Program:** The program is focused on managing the effects of cracking due to SCC, IGSCC, or IASCC. The program contains preventive measures to mitigate SCC, IGSCC, or IASCC; ISI to monitor the effects of cracking on the intended function of the components; and repair and/or replacement as needed to maintain the ability to perform the intended function of BWR vessel internals.

The BWRVIP documents provide generic guidelines intended to present the applicable inspection recommendations to assure safety function integrity of the subject safety-related reactor pressure vessel internal components. The guidelines include information on component description and function; evaluate susceptible locations and safety consequences of failure; provide recommendations for methods, extent, and frequency of inspection; discuss acceptable methods for evaluating the structural integrity significance of flaws detected during these examinations; and recommend repair and replacement procedures.

The various applicable BWRVIP guidelines are as follows:

*Core shroud*: BWRVIPs-07, -63, and -76 provide guidelines for inspection and evaluation; BWRVIP-02, Rev. 2, provides guidelines for repair design criteria.

*Core plate*: BWRVIP-25 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria.

*Shroud support*: BWRVIP-38 provides guidelines for inspection and evaluation; BWRVIP-52 provides guidelines for repair design criteria.

*Low-pressure coolant injection (LPCI) coupling*: BWRVIP-42 provides guidelines for inspection and evaluation; BWRVIP-56 provides guidelines for repair design criteria.

*Top guide:* BWRVIP-26 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria. Additionally, for top guides with neutron fluence exceeding the IASCC threshold (5E20, E>lMeV) prior to the period of extended operation, inspect five percent (5%) of the top guide locations using enhanced visual inspection technique, EVT-1 within six years after entering the period of extended operation.

An additional 5 percent of the top guide locations will be inspected within 12 years after entering the period of extended operation. Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5 percent of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5 percent of the top guide locations will be inspected within 12 years after the date projected for exceeding the threshold. The top guide inspection locations are those that have high neutron fluences exceeding the IASCC threshold. The extent of the examination and its frequency will be based on a 10-percent sample of the total population, which includes all grid beam and beam-to-beam crevice slots.

*Core spray*: BWRVIP-18 provides guidelines for inspection and evaluation; BWRVIP-16 and 19 provides guidelines for replacement and repair design criteria, respectively.

*Jet pump assembly*: BWRVIP-41 provides guidelines for inspection and evaluation; BWRVIP-51 provides guidelines for repair design criteria.

*Control rod drive (CRD) housing*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-58 provides guidelines for repair design criteria.
*Lower plenum*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-57 provides guidelines for repair design criteria for instrument penetrations. In addition, BWRVIP-44 provides guidelines for weld repair of nickel alloys; BWRVIP-45 provides guidelines for weldability of irradiated structural components.

**Detection of Aging Effects:** The extent and schedule of the inspection and test techniques prescribed by the applicable and approved BWRVIP guidelines are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of BWR vessel internals. Inspection can reveal cracking. Vessel internal components are inspected in accordance with the requirements of ASME Section XI, Subsection IWB, examination category B-N-2. The ASME Section XI inspection specifies visual VT-1 examination to detect discontinuities and imperfections, such as cracks, corrosion, wear, or erosion, on the surfaces of components. This inspection also specifies

> visual VT-3 examination to determine the general mechanical and structural condition of the component supports by (a) verifying parameters, such as clearances, settings, and physical displacements, and (b) detecting discontinuities and imperfections, such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion.
>
> The applicable and approved BWRVIP guidelines recommend more stringent inspections, such as enhanced visual VT-1 examinations or ultrasonic methods of volumetric inspection, for certain selected components and locations. The NDE techniques appropriate for inspection of BWR vessel internals including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03.

The applicant stated in the PNPS LRA that Exception 3, affecting the recommended inspection for three inaccessible welds inside each core spray nozzle, is acceptable because inspection of similar creviced and uncreviced welds (including junction box-to-pipe welds, upper elbow welds, junction box cover plate weld, P1 weld, and down comer sleeve welds) showed no indication of cracking. The applicant stated that, therefore, deferral of inspection of the inaccessible welds is justified.

During the audit and review, the project team reviewed the PNPS Reactor Vessel Internals Program's inspection and implementing procedure and the technical justification for inspection deferral of core spray hidden welds contained therein. The PNPS technical justification states that there are three hidden welds inside each of the two core spray nozzle thermal sleeves, the hidden welds are not accessible for visual examination, and currently no inspection technique has been developed to inspect the thermal sleeve welds either with some degree of component disassembly or through development of specialized tooling. The technical justification further states that, according to BWRVIP-18, a qualitative assessment of thermal sleeve integrity can be based on a plant-specific evaluation of similar core spray piping welds (evaluation welds); the technical justification further states that at PNPS none of the evaluation welds (28 welds in all) show any indications of cracking. The technical justification also states that, according to BWRVIP-18, if a thermal sleeve weld were to crack to the point of separation, the thermal sleeve and attached core piping might undergo some displacement. However, the brackets holding the piping and/or the tight clearance between the thermal sleeve and nozzle wall would prevent gross separation and, in such an extreme scenario, core spray would still be provided but with some leakage.

During the audit and review, the project team also reviewed the PNPS BWR Reactor Vessel Internals Program's inspection program document and determined that the program includes a requirement that when tooling becomes available, the core spray hidden welds shall be inspected per the requirements of BWRVIP-18. The project team asked the applicant to provide a status summary of current industry activities to develop a delivery system for ultrasonic testing of the hidden welds in PNPS' core spray system. In response to this request, the applicant provided the following information:

> The BWRVIP/EPRI NDE Center recently acquired blade probes to demonstrate UT capability. Plans for 2007 are to develop a white paper to document the inspection capability to examine the hidden thermal sleeve welds. This project excludes tooling development as it

is left to inspection vendors.

Based upon review of the applicant's technical justification for deferring inspection of the hidden core spray thermal sleeve welds and upon the applicant's response, the project team determined that 1) currently there is no qualified tooling that would support inspection of the hidden core spray thermal sleeve welds, 2) PNPS currently examines other welds in the reactor vessel that have the same material and environment conditions as the hidden welds, 3) the industry through BWRVIP/EPRI is planning to develop a white paper to document capability to examine the hidden welds, and 4) PNPS's BWR Vessel Internals Program guidance document includes a requirement to inspect the hidden welds when appropriate tooling is developed. Based upon these determinations, the project team found Exception 3 to the BWR Vessel Internals Program as described in the GALL Report to be acceptable.

Exception 4

Elements: 1: Scope of Program
4: Detection of Aging Effects

Exception: **Jet Pump Assembly:** PNPS defers inspection of jet pump inaccessible welds until a delivery system for ultrasonic testing of the hidden welds is developed. Thus, PNPS does not meet the BWRVIP-41 requirement to perform a modified VT-1 of 100 percent of these welds over two 6-year inspection cycles and 25 percent per inspection cycle thereafter.

The GALL Report identified the following recommendations for the "Scope of Program" and "Detection of Aging Effects" program elements associated with the exceptions taken:

**Scope of Program:** The program is focused on managing the effects of cracking due to SCC, IGSCC, or IASCC. The program contains preventive measures to mitigate SCC, IGSCC, or IASCC; ISI to monitor the effects of cracking on the intended function of the components, and repair and/or replacement as needed to maintain the ability to perform the intended function of BWR vessel internals.

The BWRVIP documents provide generic guidelines intended to present the applicable inspection recommendations to assure safety function integrity of the subject safety-related reactor pressure vessel internal components. The guidelines include information on component description and function; evaluate susceptible locations and safety consequences of failure; provide recommendations for methods, extent, and frequency of inspection; discuss acceptable methods for evaluating the structural integrity significance of flaws detected during these examinations; and recommend repair and replacement procedures.

The various applicable BWRVIP guidelines are as follows:

*Core shroud*: BWRVIPs-07, -63, and -76 provide guidelines for inspection and evaluation; BWRVIP-02, Rev. 2, provides guidelines for repair design criteria.

*Core plate*: BWRVIP-25 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria.

*Shroud support*: BWRVIP-38 provides guidelines for inspection and evaluation; BWRVIP-52 provides guidelines for repair design criteria.

*Low-pressure coolant injection (LPCI) coupling*: BWRVIP-42 provides guidelines for inspection and evaluation; BWRVIP-56 provides guidelines for repair design criteria.

*Top guide:* BWRVIP-26 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria. Additionally, for top guides with neutron fluence exceeding the IASCC threshold (5E20, E>IMeV) prior to the period of extended operation, inspect five percent (5%) of the top guide locations using enhanced visual inspection technique, EVT-1 within six years after entering the period of extended operation.

An additional 5 percent of the top guide locations will be inspected within 12 years after entering the period of extended operation. Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5 percent of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5 percent of the top guide locations will be inspected within 12 years after the date projected for exceeding the threshold. The top guide inspection locations are those that have high neutron fluences exceeding the IASCC threshold. The extent of the examination and its frequency will be based on a 10-percent sample of the total population, which includes all grid beam and beam-to-beam crevice slots.

*Core spray*: BWRVIP-18 provides guidelines for inspection and evaluation; BWRVIP-16 and 19 provides guidelines for replacement and repair design criteria, respectively.

*Jet pump assembly*: BWRVIP-41 provides guidelines for inspection and evaluation; BWRVIP-51 provides guidelines for repair design criteria.

*Control rod drive (CRD) housing*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-58 provides guidelines for repair design criteria.

*Lower plenum*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-57 provides guidelines for repair design criteria for instrument penetrations. In addition, BWRVIP-44 provides guidelines for weld repair of nickel alloys; BWRVIP-45 provides guidelines for weldability of irradiated structural components.

**Detection of Aging Effects:** The extent and schedule of the inspection and test techniques prescribed by the applicable and approved BWRVIP guidelines are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of BWR vessel internals. Inspection can reveal cracking. Vessel internal components are inspected in accordance with the requirements of ASME Section XI, Subsection IWB, examination category B-N-2. The ASME Section XI inspection specifies visual VT-1 examination to detect discontinuities and imperfections, such as cracks, corrosion, wear, or erosion, on the surfaces of components. This inspection also specifies visual VT-3 examination to determine the general mechanical and structural condition of the component supports by (a) verifying parameters, such as clearances, settings, and physical displacements, and (b) detecting discontinuities and imperfections, such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion.

The applicable and approved BWRVIP guidelines recommend more stringent inspections, such as enhanced visual VT-1 examinations or ultrasonic methods of volumetric inspection, for certain selected components and locations. The nondestructive examination (NDE) techniques appropriate for inspection of BWR vessel internals including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03.

The applicant stated, in the PNPS LRA that Exception 4, affecting the recommended inspection of jet pump assembly inaccessible welds, is acceptable because the hidden jet pump welds are far enough into the nozzle that failure at these welds would not result in the thermal sleeve disengaging from the nozzle before the riser contacted the shroud. Further, if the jet pump thermal sleeve was severed, the riser brace would maintain the geometry of the jet pump well past the time that leakage would be detected through operational parameters and the plant could be safely shutdown. The applicant further stated that, in addition, PNPS instituted hydrogen water chemistry in 1991 to mitigate cracking in the reactor internals and to address crack growth in the jet pump thermal sleeve welds in particular. Therefore, deferral of inspection of the inaccessible welds is justified.



During the audit and review, the project team reviewed the PNPS BWR Reactor Vessel Internals Program's inspection and implementing procedure and the technical justification for inspection deferral of jet pump hidden welds contained therein. The applicant's technical justification states that there are two hidden welds (TS-3 and TS-4) inside each of the jet pump recirculation inlet nozzles; and these are described as circumferential welds that attach the thermal sleeve in a trombone arrangement inside each of the 10 jet pump recirculation inlet nozzles. The project team reviewed BWRVIP-41, Figure 2.3.3-1, Configurations for Thermal Sleeves, and determined that the TS-4 weld attaches the outer thermal sleeve to the vessel nozzle wall and the TS-3 weld attaches the inner thermal sleeve to the outer thermal sleeve. The applicant's technical justification further states that the hidden welds are not accessible for visual examination and that there is currently no inspection technique developed to inspect the thermal sleeve welds either with some degree of component disassembly or through development of specialized tooling. The applicant's technical justification states that there are three accessible welds in each of the 10 jet pump risers (RS-1, RS-2, and RS-3) that are made of similar material, in a similar environment, and subject to similar operational loading. These riser welds can be considered to be similar indicator welds for the hidden thermal sleeve welds. The technical justification notes that no cracking was found in the hidden thermal sleeve welds when they were accessible during the recirculation piping replacement performed at RFO 6 (1984). The justification states that PNPS has inspected the similar riser sleeve welds, as recommended by BWRVIP-41, during recent refueling outages and will continue to do so during the period of extended operation. It also states that all of the similar riser sleeve welds have been found to be free of cracks. The justification states that technical specifications contain jet pump operability criteria for monitoring jet pump integrity and that even if the jet pump thermal sleeve was severed, the riser brace would maintain the geometry of the jet pump well past the time when failure of the weld would be detected through operational parameters. This would ensure that the plant could be safely shut down.

During the audit and review, the project team also reviewed the PNPS BWR Reactor Vessel Internals Program's inspection program document and determined that the program includes a requirement that when tooling becomes available the hidden welds in the jet pump thermal sleeves shall be inspected per the requirements of BWRVIP-41. The project team asked the applicant to provide a status summary of current industry activities to develop a delivery system for ultrasonic testing of the hidden welds in PNPS' core spray system. In response to this request, the applicant provided the following information:

> The BWRVIP/EPRI NDE Center recently acquired blade probes to demonstrate UT capability. Plans for 2007 are to develop a white paper to document the inspection capability to examine the hidden thermal sleeve welds. This project excludes tooling development as it is left to inspection vendors.

Based upon review of the applicant's technical justification for deferring inspection of the hidden welds in the jet pump thermal sleeves and upon the applicant's response, the project team determined that 1) currently there is no qualified tooling that would support inspection of the hidden welds in the jet pump thermal sleeves, 2) PNPS currently examines other welds in the reactor vessel that have the same material and environment conditions as the hidden welds, 3) the industry through BWRVIP/EPRI is planning to develop a white paper to document capability to examine the hidden welds, and 4) PNPS's BWR Vessel Internals Program guidance document includes a requirement to inspect the hidden welds when appropriate tooling is developed. Based upon these determinations, the project team found Exception 4 to the BWR Vessel Internals Program as described in the GALL Report to be acceptable.

During review of the applicant's technical justification for deferral of inspection of hidden welds in the jet pump thermal sleeves, the project team noted that the technical justification states that PNPS has known cracking in 9 out of 10 of the thermal sleeves (but not in the TS-3 and TS-4 welds) and that this was discovered by a combination of penetrant testing and radiography when the thermal sleeves were accessible during the recirculation pipe replacement in RFO6 (1984). The technical justification states that the thermal sleeve cracking was intermittent cracking and was predominantly, but not exclusively, confined to the heat affected zones (HAZ) of pallet fillet welds on the outer thermal sleeve where pads were shop welded onto the outer thermal sleeve as an assembly aid, and that the indications were quite limited in extent. The technical justification further states that the plans were to leave the existing thermal sleeves in place and suppress further cracking through the use of hydrogen water chemistry (HWC). The project team asked the applicant to provide a more detailed discussion of the aging management that will provided for the jet pump thermal sleeves, including considerations of the cracking that was observed during the recirculation pipe replacement. In response to this request, the applicant provided the following information:

**{RESPONSE TO NEW QUESTION B.1.8-J-10GOES HERE}**

Based upon ....{NEED TO SEE THE RESPONSE}..... the project team found the applicant's response to be acceptable... **{OR, DEPENDING ON THE TIMELINESS AND COMPLETENESS OF THEIR RESPONSE, THIS MAY HAVE POTENTIAL FOR BECOMING AN RAI.}**

During the audit and review, the project team asked the applicant to confirm whether PNPS has installed the core plate wedges that are described in BWRVIP-25 or whether PNPS will perform the inspection of core plate rim hold-down bolts recommended in BWRVIP-25 if wedges are not installed. In response to this question, the applicant stated that the core plate wedges have been installed, and they are described in UFSAR Section 3.3.4.1.1, Core Shroud. The project team review the description in UFSAR Section 3.3.4.1.1 and the requirements in BWRVIP-25. On the basis of its review, the project team determined that PNPS has installed the core plate wedges described in BWRVIP-25 and that with the wedges installed, the recommendations in BWRVIP-25, Table 3-2, Summary of Results and Inspection Recommendations, do not require examination of the core plate rim hold down bolts.

Based upon its evaluation of Exception 4 to the PNPS BWR Vessel Internals Program as described in the preceding discussions, the project team found the applicant's technical justification of this exception to the BWR Vessel Internals Program as described in the GALL Report to be acceptable. In addition, as summarized in the preceding discussions, the project team found the applicant's responses to additional, clarifying questions to be acceptable. On this basis, the project team found this exception acceptable.



<u>Exception 5</u>

| | |
|---|---|
| Elements: | 3: Parameters Monitored/Inspected |
| Exception: | Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG 1801 specifies the 2001 edition with 2002 and 2003 addenda. |

The GALL Report identified the following recommendations for the "Parameters Monitored/Inspected" program elements associated with the exception taken:

> The program monitors the effects of cracking on the intended function of the component by detection and sizing of cracks by inspection in accordance with the guidelines of applicable and approved BWRVIP documents and the requirements of the ASME Code, Section XI, Table IWB 2500-1 (2001 edition including the 2002 and 2003 Addenda). An applicant may use the guidelines of BWRVIP-62 for inspection relief for vessel internal components with hydrogen water chemistry provided such relief is submitted under the provisions of 10 CFR 50.55a and approved by the staff.

The applicant stated, in the PNPS LRA, that ASME Section XI through the 2003 has been accepted by reference in 10 CFR 50.55a paragraph (b)(2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components. Therefore, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

During the audit and review, the project team asked the applicant to confirm that PNPS' BWR Vessel Internals Programperforms the inspections recommended in the applicable and approved BWRVIP guidelines, including those inspections that have more stringent requirements than ASME Section XI except as documented in PNPS LRA under the discussion of "Exceptions to NUREG-1801." In response to this question, the applicant provided the following information:

> The PNPS BWR Vessel Internals Program will perform the more stringent inspections in the BWRVIP inspection and evaluation guidelines approved by the NRC for referencing for license renewal. Any exceptions to the approved BWRVIPs are discussed as exceptions to NUREG-1801.
>
> Note that some of the specific BWRVIPs are considered part of subprograms such as the BWR Penetrations Programor the BWR Vessel ID Attachment Welds Program; however, all are implemented through the Reactor Vessel Internals Program implementing procedure at the PNPS site.

The project team reviewed the applicant's responses, together with the applicant's fourth 10-year inspection program plan (ML051920157). The project team also reviewed the applicant's response to BWRVIP applicant action items as documented for PNPS in Appendix C of the LRA. Based on these reviews, the project team determined that the applicant's use of ASME Section XI, 1998 edition with 2000 addenda, as the basis for their BWR Vessel Internals Program is consistent with the applicant's fourth 10-year inspection programplan. In addition the project team determined that the applicant has complied with the applicant action items identified in NRC safety evaluation reports for BWRVIP documents credited for license renewal. Based upon these determinations, the project team found Exception 5 to the BWR Vessel Internals Program as described in the GALL report to be acceptable. On this basis, the project team found this exception acceptable.

3.0.3.2.7.4 Enhancements

The applicant stated, in the PNPS LRA, that the enhancement in meeting the GALL Report programelement is as follows:

| | |
|---|---|
| Element: | 1: Scope of Program |
| Enhancement: | The PNPS top guide fluence is projected to exceed the threshold for IASCC ($5x10^{20}$ $n/cm^2$) prior to the period of extended operation. Therefore, 10 percent of the top guide locations will be inspected using enhanced visual inspection technique, EVT-1, within the first 12 years of the period of extended operation, with one half of the inspections (50 percent of locations) to be completed within the first 6 years of the period of extended operation. Locations selected for examination will be areas that have exceeded the neutron fluence threshold. |

The GALL Report identified the following recommendation for the "Scope of Program" program element associated with the enhancement:

> The program is focused on managing the effects of cracking due to SCC, IGSCC, or IASCC. The program contains preventive measures to mitigate SCC, IGSCC, or IASCC; ISI to monitor the effects of cracking on the intended function of the components; and repair and/or replacement as needed to maintain the ability to perform the intended function of BWR vessel internals.
>
> The BWRVIP documents provide generic guidelines intended to present the applicable inspection recommendations to assure safety function integrity of the subject safety-related reactor pressure vessel internal components. The guidelines include information on component description and function; evaluate susceptible locations and safety consequences of failure; provide recommendations for methods, extent, and frequency of inspection; discuss acceptable methods for evaluating the structural integrity significance of flaws detected during these examinations; and recommend repair and replacement procedures.
>
> The various applicable BWRVIP guidelines are as follows:
>
> *Core shroud*: BWRVIPs-07, -63, and -76 provide guidelines for inspection and evaluation; BWRVIP-02, Rev. 2, provides guidelines for repair design criteria.
>
> 
>
> *Core plate*: BWRVIP-25 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria.
>
> *Shroud support*: BWRVIP-38 provides guidelines for inspection and evaluation; BWRVIP-52 provides guidelines for repair design criteria.
>
> *Low-pressure coolant injection (LPCI) coupling*: BWRVIP-42 provides guidelines for inspection and evaluation; BWRVIP-56 provides guidelines for repair design criteria.
>
> *Top guide:* BWRVIP-26 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria. Additionally, for top guides with neutron fluence exceeding the IASCC threshold (5E20, E>lMeV) prior to the period of extended operation, inspect 5 percent of the top guide locations using enhanced visual inspection technique, EVT-1 within six years after entering the period of extended operation. An additional 5 percent of the top guide locations will be inspected within 12 years after entering the period of extended operation. Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5 percent of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5 percent of the top guide locations will be inspected within 12 years after the date projected for exceeding the threshold. The top guide inspection locations are those that have high neutron fluences exceeding the IASCC threshold. The extent of the examination and its frequency will be based on a 10-percent sample of the total population, which includes all grid beam and beam-to-beam crevice slots.

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*Core spray*: BWRVIP-18 provides guidelines for inspection and evaluation; BWRVIP-16 and 19 provides guidelines for replacement and repair design criteria, respectively.

*Jet pump assembly*: BWRVIP-41 provides guidelines for inspection and evaluation; BWRVIP-51 provides guidelines for repair design criteria.

*Control rod drive (CRD) housing*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-58 provides guidelines for repair design criteria.

*Lower plenum*: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-57 provides guidelines for repair design criteria for instrument penetrations. In addition, BWRVIP-44 provides guidelines for weld repair of nickel alloys; BWRVIP-45 provides guidelines for weldability of irradiated structural components.

The applicant stated, in the PNPS LRA, that this enhancement will be initiated prior to the period of extended operation.

During the audit and review, the project team noted that the LRA describes this and other enhancements as "initiated" prior to the period of extended operation. The project team noted that in describing an enhancement as something to be "initiated," rather than "implemented," the LRA wording is ambiguous with regard to whether the enhancement will be fully implemented prior to the period of extended operation. The project team asked the applicant to clarify or resolve the ambiguity in the LRA's descriptions of enhancements. In its letter dated **mm-dd-yyyy (MLxxxxxxxxxx)**, the applicant stated that the intent of saying that enhancements will be initiated prior to the period of extended operation is that the enhancements will be fully implemented prior to the period of extended operation. **{OPEN ITEM}**. Since this response provided the clarification requested, the project found it to be acceptable.

During the audit and review, the project team noted that the enhancement, as described in the LRA, does not provide for any examination of the top guide during the final 8 years of the period of extended operation. The project team asked the applicant to describe their plans for inspection of top guide locations during the final 8 years of the 20-year period of extended operation. In its letter dated **mm-dd-yyyy(MLxxxxxxxxxx)** the applicant provided the following response:

> As indicated in LRA Section B.1.8, BWR Vessel Internals, under Enhancements, 10 percent of the top guide locations will be inspected using enhanced visual inspection techniques, EVT-1, within the first 12 years of the period of extended operation, with one-half of the inspections (50 percent of the locations) to be completed within the first 6 years of the period of extended operation. This enhancement will be revised to require inspection of an additional 5 percent of the top guide locations during the third 6 years of the period of extended operation. This change to the enhancement will be provided in an amendment to the LRA. **{OPEN ITEM}**

The project team reviewed the applicant's response together with the applicant's evaluation of the "scope of program" element of their current BWR Vessel Internals Program documented in the PNPS Aging Management Program Evaluation Report. The project team determined that the applicant's program evaluation report identifies that the enhancement to inspect top guide locations, as described in the LRA's description of the enhancement, is necessary to bring the PNPS BWR Vessel Internals Program into conformance with the recommendations of BWRVIP-26 guidelines. The project team also reviewed selected PNPS implementing procedures and found that the current PNPS BWR Vessel Internals Program does not include the requirement for top guide inspection as recommended in BWRVIP-26. On the basis that the enhancement is necessary to ensure conformance with guidelines of BWRVIP-26 as recommended in the GALL Report during the period of extended operation and that the applicant has revised the enhancement as originally described in the LRA to include appropriate examinations during the final 8 years of the period of extended operation, the project team found that the enhancement to the PNPS BWR Vessel Internals Program is acceptable.

On this basis, the project team found this enhancement acceptable because when the enhancement is implemented, PNPS AMP B.1.8, "BWR Vessel Internals Program," will be consistent with GALL AMP XI.M9 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.2.7.5 <u>Operating Experience</u>

The applicant stated, in the PNPS LRA, that visual and enhanced visual examinations of vessel internals (shroud support plate gusset welds, core spray piping, jet pump riser braces, jet pump diffusers, CRD guide tube handle attachment, steam dryer, and feedwater spargers) during RFO14 (April 2003) resulted in no new recordable indications. Previous visual and enhanced visual examinations of vessel internals revealed indications on core spray piping welds, and steam dryer leveling screw tack welds. Absence of new recordable indications on the vessel internals provides evidence that the program is effective for managing cracking of the welds.

Visual and enhanced visual examinations of vessel internals (core spray piping welds, core spray spargers, integrally welded core support structures, jet pump restrainer wedges, shroud vertical welds, shroud top guide ring, shroud support, steam dryer, steam dryer level screw tack weld cracks, steam separator/shroud head, and top guide grid beams) during RFO15 (April 2005) resulted in no new recordable indications. Absence of new recordable indications on the vessel internals provides evidence that the program is effective for managing cracking of the welds.

The core shroud provides 2/3-core coverage in case of a LOCA. Because IGSCC cracking of sensitized shroud welds was an industry issue, PNPS implemented a preemptive shroud holddown modification during RFO10 in 1995.

During the audit and review, the project team noted that the discussion of operating history in the LRA included little discussion of operating history earlier than approximately 2000. The project team asked the applicant to discuss the limitations on their discussion of operating history in the LRA and whether it is consistent with the requirements described in NUREG-1800, SRP-LR, Appendix A, Section A.1.2.3.10 (Branch Technical Position RLSB-1, Operating Experience). In response to this request, the applicant provided the following statement:

SRP Section A.1.2.3.10 states, "Operating experience with existing programs should be discussed." To identify operating experience for license renewal, Entergy focused on operating experience with the existing programs rather than operating experience from the program that existed 10 or 15 years ago. Entergy did not own the plant 10 years ago. Entergy focused on operating experience from the existing programs rather than operating experience from the program that existed 10 or 15 years ago because results of the earlier inspections do not provide information regarding existing program effectiveness. In addition, BWRVIP programs incorporate industry operating experience from the entire BWR fleet. The PNPS programs are based on NUREG-1801 programs which are also based on industry experience.

The project team determined that the applicant's response provided a reasonable explanation of their decisions regarding presentation of "operating experience" in the LRA and that, based on this response, the LRA presentation of "operating experience" is consistent with the recommendations of SRP-LR, Appendix A, Section A.1.2.3.10. On this basis, the project team found the applicant's response to be acceptable.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the BWR Vessel Internals Program and did not find any evidence of PNPS equipment degradation or failures that are outside the envelope of 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 concluded that the applicant's BWR Vessel Internals Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.7.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the BWR Vessel Internals Program in PNPS LRA, Appendix A, Section A.2.1.8, which states that the BWR Vessel Internals Program includes (a) inspection, flaw evaluation, and repair in conformance with the applicable, staff-approved BWR Vessel and Internals Project (BWRVIP) documents, and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel internals components.

During the audit and review, the project team noted that the applicant's description of the BWR Vessel Internals Program in the UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the enhancement described in LRA, Appendix B.1.8, BWR Vessel Internals. The project team asked the applicant to include a description of the enhancement to PNPS' BWR Vessel Internals Program in the UFSAR Supplement in LRA, Appendix A. In response to this request, the applicant stated that the program description in Appendix A will be revised to identify the commitment number associated with the enhancement for the BWR Vessel Internals Program as described in LRA Appendix B. The program description in Appendix A will be amended to include the following statement:

License renewal commitment number 3 specifies an enhancement to this program.

This will require an amendment to the license renewal application. **{OPEN ITEM}**

**{WRJ Note: We will also need to confirm that the commitment has been rewritten to include the inspection for the third six-years during the PEO. As originally written, it described only the first two inspections.}**

The project team reviewed the UfSAR Supplement for PNPS AMP B.1.8, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.7.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 DIESEL FUEL MONITORING PROGRAM (PNPS AMP B.1.10)

In PNPS LRA, Appendix B, Section B.1.10, the applicant stated that PNPS AMP B.1.10, "Diesel Fuel Monitoring Program," is an existing plant program that is consistent with GALL AMP XI.M30, "Fuel Oil Chemistry," with exceptions and enhancements.

3.0.3.2.8.1 Program Description

The applicant stated, in the PNPS LRA, that the program entails sampling to ensure that adequate diesel fuel quality is maintained to prevent plugging of filters, fouling of injectors, and corrosion of fuel systems. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic draining and cleaning of tanks and by verifying the quality of new oil before its introduction into the storage tanks. Sampling and analysis activities are in accordance with technical specifications on fuel oil purity and the guidelines of ASTM Standards D4057-81 and D975-81 (or later revisions of these standards).

3.0.3.2.8.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.10 is 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 audit and review report for PNPS AMP B.1.10, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.9, "Diesel Fuel Monitoring Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M30. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.10 and associated bases documents to determine consistency with GALL AMP XI.M30.

The project team also reviewed PNPS Operating Experience Review Report, LRPD-05, Revision 0, Section 4.9, "Diesel Fuel Monitoring Program;" Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure), ASTM D 1796; Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling, ASTM D 2276; Standard Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration, ASTM D 6217; Standard Specification for Diesel Fuel Oils, ASTM D 975; Standard Practice for Manual Sampling of Petroleum and Petroleum Products, ASTM D 4057; Standard Method for Water and Sediment in Middle Distillate Fuels by Centrifuge, ASTM D 2709; Standard Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration, ASTM D 6217.



The project team reviewed those portions of the Diesel Fuel Monitoring Program for which the applicant claims consistency with GALL AMP XI.M30 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's Diesel Fuel Monitoring Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Diesel Fuel Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.M30, "Fuel Oil Chemistry," with the exceptions and enhancements as described below.

3.0.3.2.8.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exceptions to the GALL Report program elements are as follows:

Exception 1

Elements: 1: Scope of Program
6: Acceptance Criteria

Exception: PNPS indicated in the LRA that sampling and analysis activities are in accordance with technical specifications on fuel oil purity and the guidelines of ASTM Standards D 4057-81 and D 975-81. However, NUREG-1801, Rev. 1

specifies ASTM Standards D 1796, D 2276, D 2709, and D 6217.

The GALL Report identified the following recommendations for the "Scope of Program" and "Acceptance Criteria" program elements associated with the exception taken:

> **Scope of Program:** The program is focused on managing the conditions that cause general, pitting, and microbiologically-influenced corrosion (MIC) of the diesel fuel tank internal surfaces in accordance with the plant's technical specifications ( i.e., NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433) on fuel oil purity and the guidelines of ASTM Standards D 1796, D 2276, D 2709, D 6217, and D 4057. The program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and microbiological organisms.

> **Acceptance Criteria:** The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for guidance on the determination of water and sediment contamination in diesel fuel. ASTM D 6217 and Modified D 2276, Method A are used for guidance for determination of particulates. The modification to D 2276 consists of using a filter with a pore size of 3.0 mm, instead of 0.8 mm.

The applicant stated, in the PNPS LRA, that PNPS technical specifications specify use of ASTM D975-81, which recommends use of ASTM D2276. Therefore, the guidelines of D2276 are appropriate for determination of particulates.

During the audit and review, the project team asked the applicant to provide justification for not using all ASTM specifications as indicated in NUREG 1801, Rev. 1. In its response, the applicant stated that the Diesel Fuel Monitoring Program makes use of the guidelines of ASTM D-2276 for determination of particulates in lieu of ASTM D-6217. ASTM D-2276 provides guidance on determining particulate contamination using a field monitor. It provides for rapid assessment of changes in contamination level without the time delay required for rigorous laboratory procedures. It also provides a laboratory filtration method using a 0.8 micron filter. ASTM D-6217 provides guidance on determining particulate contamination by sample filtration at an off-site laboratory. The acceptance criterion of D-2276 is 10 mg/liter while that of D-6217 is 24 mg/liter. Therefore, D-2276 criterion is more stringent than that of D-6217. Since ASTM D-2276 is an accepted method of determining particulates and is a method recommended by ASTM D-975, the D-2276 method is used at PNPS.

On this basis, the project team found this exception acceptable.

<u>Exception 2</u>

| | |
|---|---|
| Elements: | 2: Preventive Actions |
| Exception: | The applicant indicated that no additives are used beyond those added by the refiner. The applicant does not add biocides, stabilizers, or corrosion inhibitors as required by NUREG 1801, Rev 1., XI.M30. |

The GALL Report identified the following recommendation for the "Preventive Actions" program element 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. 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. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms.

The applicant stated, in the PNPS LRA, that PNPS does not add biocides, stabilizers, or corrosion inhibitors to the diesel fuel. Plant-specific operating experience has not indicated significant problems related to MIC. Since water contamination in the diesel fuel storage tanks is minimized, the potential for MIC is limited.

During the audit and review, the project team found program documentation indicating that tanks, except the security diesel generator fuel storage tank, are periodically drained, cleaned, and inspected. The quality of new oil is verified before it is introduced to storage tanks. This exception to NUREG 1801, Rev. 1 is acceptable for all tanks, except the security diesel generator fuel storage tank, because no degradation of or water contamination in the fuel storage tanks has been detected to date and the Diesel Fuel Monitoring Program will be enhanced to include UT of the bottom of tanks (except the security diesel generator fuel storage tank). If indications of degradation or water contamination are found in the future, PNPS will consider additions of corrosion inhibitors and biocides during the corrective action process. On this basis, the project team found this exception acceptable.

Exception 3

Elements: 2: Preventive Actions

Exception: The security diesel generator fuel storage tank is not periodically cleaned and inspected because the internals are inaccessible.

The GALL Report identified the following recommendation for the "Preventive Actions" program element 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. 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. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms.

The applicant stated, in the PNPS LRA, that the security diesel fuel storage tank does not have manways or other means of access to the internals. Therefore, no preventative action is taken for the security diesel generator fuel storage tank because the internals are inaccessible (there are no manways or other means to access the internals).

During the audit and review, the project team asked the applicant to provide justification for not cleaning and visually inspecting the security diesel generator fuel storage tank on a periodic basis. In its response to this request, the applicant provided information with regard to how loss of material due to MIC and general corrosion will be managed. The security diesel generator fuel storage tank is a double-walled tank. Instrumentation will be added to monitor leakage between the two walls of the tank, and the fuel will be sampled for water contamination at the bottom of the tank. A modification to provide instrumentation will be installed prior to the period of extended operation. Water is necessary for MIC and general corrosion in the fuel oil environment. Verification that water is not present at the tank bottom will ensure loss of material is not occurring. This exception to NUREG 1801, Rev. 1 is acceptable for the security diesel generator fuel storage tank because the two enhancements to the program will ensure corrective action before the tank is breached due to loss of material. On this basis, the project team found this exception acceptable.

Exception 4

Elements: 3: Parameters Monitored/Inspected
6: Acceptance Criteria

Exception: Determination of particulates may be according to ASTM Standard D 2276 rather than modified ASTM D 2276 Method A.



The GALL Report identified the following recommendations for the "Parameters Monitored/Inspected" and Acceptance Criteria" program elements associated with the exception taken:

**Parameters Monitored/Inspected:** The AMP monitors fuel oil quality and the levels of water and microbiological organisms in the fuel oil, which cause the loss of material of the tank internal surfaces. The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 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 mm, instead of 0.8 mm. These are the principal parameters relevant to tank structural integrity.

**Acceptance Criteria:** The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for guidance on the determination of water and sediment contamination in diesel fuel. ASTM D 6217 and Modified D 2276, Method A are used for guidance for determination of particulates. The modification to D 2276 consists of using a filter with a pore size of 3.0 mm, instead of 0.8 mm.

The applicant stated, in the PNPS LRA, that determination of particulates may be according to ASTM Standard D2276 which conducts particulate analysis using a 0.8 micron filter, rather than the 3.0 micron filter specified in NUREG-1801. Use of a filter with a smaller pore size results in a larger sample of particulates because smaller particles are retained. Thus, use of a 0.8 micron filter is more conservative than use of the 3.0 micron filter specified in NUREG-1801.

During the audit and review, the project team determined that the procedure used by the applicant to conduct particulate levels is more conservative than that of NUREG-1801, Rev 1. It was, therefore, concluded that the testing methods adequately detect unacceptable levels of particulates. On this basis, the project team found this exception acceptable.

3.0.3.2.8.4 <u>Enhancements</u>

The applicant stated, in the PNPS LRA, that the enhancements in meeting the GALL Report program element are as follows:

<u>Enhancement 1</u>

| | |
|---|---|
| Element: | 1: Scope of Program |
| Enhancement: | The Diesel Fuel Monitoring Program will be enhanced to include periodic sampling of the security diesel generator fuel storage tank, near the bottom, to determine water content. |

The GALL Report identified the following recommendation for the "Scope of Program" program element associated with the enhancement:

> **Scope of Program:** The program is focused on managing the conditions that cause general, pitting, and microbiologically-influenced corrosion (MIC) of the diesel fuel tank internal surfaces in accordance with the plant's technical specifications (i.e., NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433) on fuel oil purity and the guidelines of ASTM Standards D1796, D2276, D2709, D6217, and D4057. The program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and microbiological organisms.

The applicant stated, in the PNPS LRA, that the Diesel Fuel Monitoring Program will be enhanced to include sampling the bottom of security diesel generator fuel storage tank for water. Any indication of water contamination will be handled in the Corrective Action Program where additions of biocides and corrosion inhibitors will be considered. Since the effect of any water contamination is minimized, the potential for MIC and general corrosion will be limited providing additional assurance that loss of material will be adequately managed.

On this basis, the project team found this enhancement acceptable since when enhancement is implemented, PNPS AMP B.1.10, "Diesel Fuel Monitoring Program," will be consistent with GALL AMP XI.M30 and will provide additional assurance that the effects of aging will be adequately managed

<u>Enhancement 2</u>

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Enhancement: | The Diesel Fuel Monitoring Program will be enhanced to include periodic ultrasonic measurement of the bottom surface of the security diesel generator fuel storage tank to ensure that significant degradation is not |

occurring.

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the enhancement:

> Degradation of the diesel fuel oil tank cannot occur without exposure of the tank internal surfaces to contaminants in the fuel oil, such as water and microbiological organisms. Compliance with diesel fuel oil standards in item 3 above and periodic multi-level sampling provide assurance that fuel oil contaminants are below unacceptable levels. 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.

The applicant stated, in the PNPS LRA, that the Diesel Fuel Monitoring Program would be enhanced to provide periodic ultrasonic inspection of the bottom surface of the security diesel generator fuel storage tank. However, during the site audit, the applicant indicated that UT is not possible at the bottom of the security diesel generator fuel storage tank because of tank geometry and installation configuration. Therefore, this enhancement was revised to add instrumentation to monitor leakage between the two walls of this double-walled tank. This enhancement to the Diesel Fuel Monitoring Program will ensure corrective action will be implemented before the outer tank wall is breached due to loss of material providing additional assurance that the effects of aging will be adequately managed. This enhancement is item #5 on the applicant's list of commitments for license renewal and will be completed prior to the period of extended operation.

On this basis, the project team found this enhancement acceptable since when enhancement is implemented, PNPS AMP B.1.10, "Diesel Fuel Monitoring Program," will be consistent with GALL AMP XI.M30 and will provide additional assurance that the effects of aging will be adequately managed

<u>Enhancement 3</u>

| | |
|---|---|
| Element: | 6: Acceptance Criteria |
| Enhancement: | UT measurements of tank bottom surfaces will have an acceptance criterion of > 60% Tnom |

The GALL Report identified the following recommendation for the "Acceptance Criteria" program element associated with the enhancement:

> The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for guidance on the determination of water and sediment contamination in diesel fuel. ASTM D 6217 and Modified D 2276, Method A are used for guidance for determination of particulates. The modification to D 2276 consists of using a filter with a pore size of 3.0 mm, instead of 0.8 mm.

The applicant stated, in the PNPS LRA, that UT measurements of tank bottom surfaces will have an acceptance criterion of > 60 % Tnom.

During the audit and review, the project team asked the applicant to provide justification for the "≥ 60% of nominal thickness" acceptance criterion. In its original response, the applicant stated that the acceptance criterion was based on one set of UT measurements where the minimum wall thickness found was 95 percent of the nominal wall thickness. During the site audit, the applicant stated although it is likely that this is due to normal variation of the wall thickness during fabrication, it was assumed that the difference in wall thickness was the result of aging degradation. Projection of this thinning rate indicated that the "≥ 60% of nominal thickness" acceptance criterion will not be exceeded during the period of extended operation even if the thinning rate was doubled. However, the project team indicated that there was no basis showing the tanks would perform their intended functions with wall thinning down to 60 percent of the nominal wall thickness. Therefore, the applicant revised this enhancement to specify acceptance criterion for UT measurements of the emergency diesel generator fuel storage tanks (T-126A&B). This enhancement is item #6 on the applicant's list of commitments for license renewal and will be completed prior to the period of extended operation. This revised enhancement requires an amendment to the LRA.

During the audit and review, the project team asked two additional questions regarding UT measurements of the diesel fuel tanks:



(1) Will tank bottoms be subjected to 100-percent UT inspection?

In its response, the applicant stated that tank bottoms would not be 100-percent inspected. Rather, a periodic UT measurement is performed on the bottom surface of the underground emergency diesel fuel oil storage tanks. During these inspections, UT measurements are made at several random locations on the bottom of these tanks. This response is acceptable because random measurements will be able to trend any loss of material to the tank bottoms.

(2) If reduction of thickness is discovered during UT, will microbiological activity be monitored and biocide added in the future? If not, provide a justification for not doing so.

In its response, the applicant stated that in accordance with the Corrective Action Program, an engineering evaluation into the cause will be performed if test acceptance criteria are not met and corrective actions will be implemented to ensure that the intended function of the tanks can be maintained consistent with the current licensing basis for the period of extended operation. If appropriate to address the cause, biocide addition may be an element of the corrective action. This response is acceptable because no evidence of MIC in diesel fuel storage tanks has been discovered to date, and biocide addition will be considered during the corrective action if evidence of MIC is discovered (e.g., during UT measurements or visual examinations).

On this basis, the project team found this enhancement acceptable because when the enhancement is implemented, PNPS AMP B.1.10, "Diesel Fuel Monitoring Program," will be consistent with GALL AMP XI.M30 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.2.8.5 Operating Experience

The applicant stated, in the PNPS LRA, that in 2001, two diesel fuel oil deliveries were rejected; one because the oil viscosity was too low and one because the oil had detectable visible particulate contamination. Rejection of inferior fuel shipments maintains diesel fuel quality to prevent loss of material and cracking of fuel system components.

Monthly sampling of the B EDG fuel oil tank and the B SBO fuel oil tank in August 2003 indicated a small amount of water was in the tanks. Gaskets were replaced although the indication of water was determined to be a false positive. The tanks were confirmed to be water-free during subsequent testing. Sampling of the B EDG fuel oil tank in January 2005 indicated a small amount of water was in the tank. However, subsequent testing confirmed the tank to be water-free. Other fuel oil sampling results from 2000 through August 2005 reveal that fuel oil quality is being maintained in compliance with acceptance criteria. A 1998 visual and ultrasonic inspection of A and B diesel fuel oil storage tank internals revealed no degradation. A 2002 visual inspection of A and B SBO fuel oil storage tank internals revealed no degradation. Continuous confirmation of diesel fuel quality, timely corrective actions, and absence of degradation in the fuel oil storage tanks provide evidence that the program is effective in managing loss of material and cracking of fuel system components.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the Diesel Fuel Monitoring Program and did not find any evidence of PNPS component degradation or failures that are outside the envelope of 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 concluded that the applicant's Diesel Fuel Monitoring Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.8.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Diesel Fuel Monitoring Program in PNPS LRA, Appendix A, Section A.2.1.10, which states that the Diesel Fuel Monitoring Program entails sampling to ensure that adequate diesel fuel quality is maintained to prevent plugging of filters, fouling of injectors, and corrosion of fuel systems. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic draining and cleaning of tanks and by verifying the quality of new oil before its introduction into the storage tanks.

During the audit and review, the project team noted that the applicant's description of the B.1.10 program in UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the enhancements described in LRA, Appendix B.1.10. The project team asked the applicant to include a description of the enhancements to PNPS' B.1.10 program in the UFSAR Supplement in LRA, Appendix A as recommended by NUREG-1800, Section 3.X.2.4. In response to this request, the applicant stated that program description in Appendix A will be revised to identify the commitment number(s) associated with the enhancement(s) for that program as described in LRA Appendix B. The program description in Appendix A will be amended to include the following statement:

> License renewal commitment numbers 4, 5, and 6 specify enhancements to this program.

This will require an amendment to the license renewal application. **(Open item).**

**When PNPS officially issues the commitment list and the revised write-up, the appropriate commitment number should be inserted above.**

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.10, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.8.7 Conclusion



On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 FATIGUE MONITORING PROGRAM (PNPS AMP B.1.12)

In PNPS LRA, Appendix B, Section B.1.12, the applicant stated that PNPS AMP B.1.12, "Fatigue Monitoring Program," is an existing plant program that is consistent with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary," with exceptions.

3.0.3.2.9.1 Program Description

The applicant stated, in the PNPS LRA, that in order not to exceed design limits on fatigue usage, the Fatigue Monitoring Program tracks the number of critical thermal and pressure transients for selected reactor coolant system components. The program ensures the validity of analyses that explicitly assumed a specified number of thermal and pressure fatigue transients by assuring that the actual effective number of transients is not exceeded.

3.0.3.2.9.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.12 is consistent with GALL AMP X.M1, 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 audit and review report for PNPS AMP B.1.12, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.11, Fatigue Monitoring Program, which provides an assessment of the AMP elements' consistency with GALL AMP X.M1. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.12 and associated bases documents to determine consistency with GALL AMP X.M1.

The project team also reviewed Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.11, Fatigue Monitoring Program, PNPS Procedure No. 1.3.118, Rev. 1, Reactor Vessel Fatigue Cyclic Duty Monitoring Program Procedure, and License Renewal Project Reports, LRPD-03, Revision 0, and LRPD-06, Revision 0, TLAAs.

In the comparison to GALL element 6, Acceptance Criteria, the applicant stated that it was consistent with GALL. However, the comparison statement does not address environmental fatigue. As written, this statement is not consistent with GALL. The applicant was asked to clarify how it addressed environmental fatigue for this element and justify why, as written, the element is consistent with GALL Report. In its response, the applicant stated that an exception was not identified in element 6 in the LRA AMP since the exception addressed under element 2 was considered adequate. For clarification, the applicant agreed to revise LRPD-02, Revision 0, Section 4.1.11 to show an exception for element 6.

**(Open item) Also, in a letter dated mm-dd-yyyy (MLaaaaaaaaa), the applicant agreed to add element 6 to the existing exception 1 in the LRA. Section 3.0.3.2.9.3 of this audit report addresses this exception. (Open item)**

The project team reviewed those portions of the Fatigue Monitoring Program for which the applicant claims consistency with GALL AMP X.M1 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Fatigue Monitoring Program provides reasonable assurance that the applicant's Fatigue Monitoring Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Fatigue Monitoring Program acceptable because it conforms to the recommended GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary," with exceptions as described below.

3.0.3.2.9.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exceptions to the GALL Report program elements are as follows:

Exception 1

| | |
|---|---|
| Element: | 2: Preventive Actions<br>6. Acceptance Criteria |
| Exception: | The Fatigue Monitoring Program only involves tracking the number of transient cycles and does not include assessment of the impact of the reactor water environment on critical components. |

The GALL Report identified the following recommendation for the "Preventive Actions" program element associated with the exception taken:

> 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.



The GALL Report identified the following recommendation for the "Corrective Action" program element associated with the exception taken:

> The acceptance criteria involves maintaining the fatigue usage below the design code limit considering environmental fatigue effects as described under the program description.

The applicant stated, in the PNPS LRA, that the effect of the reactor water environment on fatigue is addressed as described in Section 4.3.3. In LRA Section 4.3.3, Effects of Reactor Water Environment on Fatigue Life, the applicant has appropriately addressed the effect of reactor water environment and committed to implementing a program to address those locations where the CUF will exceed 1.0. Based on the review of LRA Section 4.3.3, the project team found this exception acceptable.

Exception 2

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Exception: | The PNPS program does not provide for periodic update of the fatigue usage calculations. |

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

> The program provides for periodic update of the fatigue usage calculations.

The applicant stated, in the PNPS LRA, that updates of fatigue usage calculations are not necessary unless the number of accumulated fatigue cycles approaches the number of assumed design cycles. The PNPS program provides for periodic assessment of the number of accumulated cycles. If a design cycle assumption is approached, corrective action is taken which may include update of the fatigue usage calculation.

This exception is acceptable because this is an alternative method for ensuring that the design code limit is not exceeded.

3.0.3.2.9.4 Enhancements

None.

3.0.3.2.9.5 Operating Experience

The applicant stated, in the PNPS LRA, that industry experience has been factored into the PNPS fatigue monitoring program through incorporation of Regulatory Guides and BWRVIP documents. The locations at which CUFs are calculated include those identified in NUREG/CR-6260.

Industry experience has identified thermal stresses that were not considered in the original design of PNPS. These thermal stresses have been evaluated. PNPS will continue to evaluate future industry experience on fatigue of Class 1 components.

For recent reactor shutdowns and startups, cycle limitations did not trend toward exceeding the allowable number of cycles. This demonstrates that the program continues to monitor plant transients and track the accumulation of these transients.

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Fatigue Monitoring Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.9.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Fatigue Monitoring Program in PNPS LRA, Appendix A, Section A.2.1.12, which states that in order not to exceed design limits on fatigue usage, the Fatigue Monitoring Program tracks the number of critical thermal and pressure transients for selected reactor coolant system components. The program ensures the validity of analyses that explicitly assumed a fixed number of thermal and pressure fatigue transients by assuring that the actual effective number of transients does not exceed the assumed limit.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.12, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.9.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 FIRE PROTECTION PROGRAM (PNPS AMP B.1.13.1)

In PNPS LRA, Appendix B, Section B.1.13.1, the applicant stated that PNPS AMP B.1.13.1, "Fire Protection Program," is an existing plant program that is consistent with GALL AMP XI.M26, "Fire Protection," with exceptions and enhancements.



3.0.3.2.10.1 Program Description

The applicant stated, in the PNPS LRA, that this program includes a fire barrier inspection and a diesel-driven fire pump inspection. The fire barrier inspection 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 requires that the pump be periodically tested to ensure that the fuel supply line can perform its intended function. The program also includes periodic inspection and testing of the Halon fire suppression system.

Corrective actions, confirmation process, and administrative controls in accordance with the requirements of 10 CFR 50 Appendix B are applied to the Fire Protection Program.

3.0.3.2.10.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.13.1 is consistent with GALL AMP XI.M26, 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 audit and review report for PNPS AMP B.1.13.1, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.12, "Fire Protection Programs," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M26. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.13.1 and associated bases documents to determine consistency with GALL AMP XI.M26.

The project team also reviewed PNPS Procedure No. 8.B.1, Rev. 64, Fire Pump Test Procedure; PNPS Procedure No. 8.B.15, Rev. 36, Functional Tests of Fire Pumps - P-135, P-140, and P-181 Procedures; PNPS Procedure No. 8.B.17.1, Rev. 17, Inspection of Fire Door Assemblies Procedure; PNPS Procedure No. 8.B.17.2, Rev. 9, Inspection of Fire Damper Assemblies Procedure; PNPS Procedure No. 8.B.22, Rev. 28, HALON 1301 System - Cable Spreading Room Procedure; and PNPS Procedure No. 8.B.29, Rev. 7, Inspection of Fire Barriers Procedure.

The project team identified a difference for element 3, Parameters to be Monitored or Inspected, in that the exception taken for frequency for element 4, Detection of Aging Effects, was not taken for element 3. The applicant was asked to justify why this exception did not apply to element 3 also. In its response, the applicant stated that per NUREG-1800, SRP-LR, Section A.1.2.3.4, element 4 describes "when", "where," and "how" program data are collected. Therefore, the exception to inspection frequency was applied to element 4. PNPS did not take exception to the parameters to be monitored or inspected for penetration seals. Therefore, the exception does not apply to element 3. Based on a review of the SRP-LR guidelines, the project team found the applicant response acceptable.

The project team identified a difference for element 4, Detection of Aging Effects. The GALL report states that the periodic function test and inspection performed at least once every six months detects degradation of the Halon/$CO_2$ fire suppression system before the loss of the component intended function. However, per review of LRPD-02, Rev 1, Section 4.12.1.B.4.b, PNPS performs this test once each operating cycle, which differs from the GALL report frequency. The project team asked the applicant to justify why this is not an exception to element 4 and, if it is an exception, to revise the LRA to include it..

In response, the applicant stated that an exception should have been included in the license renewal application for AMP B.1.13.1, Fire Protection Program, element 4. **In a letter dated, XX-YY-ZZZZ (MLaaaaaaaaa), the applicant identified this exception for element 4, of AMP B.1.13.1. (Open Item)** The project team's evaluation of this exception is provided in section 3.0.3.2.10.3 of this audit and review report.

In element 3, the GALL Report states that visual inspection of the fire barrier walls, ceilings, and floors examines any sign of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. Procedure 8.B.29 addresses cracking, spalling, etc.; however, loss of material (LOM) is not addressed. The project team asked the applicant where inspection of LOM is addressed. In its response, the applicant stated that LOM for fire barrier, walls, ceilings, and floors is addressed in procedure 8.B.29, Section 8.2. This procedure section describes how each fire barrier is to be inspected. It directs inspectors to take note of any damaged portions of the barrier and lists cracks/voids/gap s in walls as an example of damage to be noted. It further states that if a major defect exists in any barrier, it will be evaluated and entered into the corrective action process. The project team reviewed the procedure 8.B.29, determined that it provides an acceptance criteria for each type of barrier, and found the applicant response acceptable.

The project team reviewed those portions of the Fire Protection Program for which the applicant claims consistency with GALL AMP XI.M26 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's Fire Protection Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Fire Protection Program acceptable because it conforms to the recommended GALL AMP XI.M26, "Fire Protection," with the exceptions and enhancements as described below.

3.0.3.2.10.3 <u>Exceptions to the GALL Report</u>

The applicant stated, in the PNPS LRA, that the exceptions to the GALL Report program elements are as follows:

<u>Exception 1</u>

Element: 1: Scope of Program
Exception: This program is not necessary to manage aging effects for carbon dioxide fire protection system components.

The GALL Report identified the following recommendation for the "Scope of Program" program element associated with the exception taken:

> For operating plants, the AMP manages the aging effects on the intended function of the penetration seals, fire barrier walls, ceilings, and floors, and all fire rated doors (automatic or manual) that perform a fire barrier function. It also manages the aging effects on the intended function of the fuel supply line. The AMP also includes management of the aging effects on the intended function of the halon/$CO_2$ fire suppression system.



The applicant stated, in the PNPS LRA, that the carbon dioxide fire suppression system is not subject to aging management review.

The project team asked the applicant to provide justification as to why the carbon dioxide fire suppression system is not subject to aging management review. In its response, the applicant stated that the CARDOX system is required for insurance purposes but is not required to protect safety-related systems. Therefore, the system has no intended functions for 10CFR54.4(a)(1) or (a)(3). Also, since the system does not contain liquids that could leak and cause physical interaction with safety-related components, it does not have any intended functions for 10CFR54.4(a)(2). Based on the above, since the system does not have any license-renewal-related intended functions, the applicant response is acceptable. On the basis that this system does not have any intended functions for 10CFR54.4(a)(1), (a)(2), or (a)(3), and is therefore not in scope of license renewal, the project team found this exception acceptable.

<u>Exception 2</u>

Element: 4: Detection of Aging Effects

Exception: The NUREG-1801 program states that approximately 10 percent of each type of penetration seal should be visually inspected at least once every refueling outage. The PNPS program specifies inspection of approximately 20 percent of the seals each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every five operating cycles.

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

Visual inspection of penetration seals detects cracking, seal separation from walls and components, and rupture and puncture of seals. Visual inspection by fire protection qualified inspectors of approximately 10 percent of each type of seal in walkdowns is performed at least once every refueling cycle. If any sign of degradation is detected within that sample, the scope of the inspection is expanded to include additional seals. Visual inspection by fire protection qualified inspectors of the fire barrier walls, ceilings, and floors, performed in walkdowns at least once every refueling outage ensures timely detection of concrete cracking, spalling, and loss of material. Visual inspection by fire protection qualified inspectors detects any sign of degradation of the fire door such as wear and missing parts. Periodic visual inspection and function tests detect degradation of the fire doors before there is a loss of intended function.

Periodic tests performed at least once every refueling outage, such as flow and discharge tests, sequential starting capability tests, and controller function tests performed on diesel-driven fire pump ensure fuel supply line performance. The performance tests detect degradation of the fuel supply lines before the loss of the component intended function. Visual inspections of the halon/$CO_2$ fire suppression system detect any sign of added degradation, such as corrosion, mechanical damage, or damage to dampers. The periodic function test and inspection performed at least once every six months detects degradation of the halon/$CO_2$ fire suppression system before the loss of the component intended function.

The applicant stated, in the PNPS LRA, that since aging effects are typically manifested over several years, this variation in inspection frequency is insignificant.

The GALL AMP XI.M26 specifies approximately 10 percent of each type of seal should be visually inspected at least once every refueling outage (2 years). The exception taken in the LRA states inspection of approximately 20 percent of seals each operating cycle, with all accessible penetration seals being inspected at least once every five operating cycles (10 years). The project team asked the applicant to identify if each type of seal is included in this 20 percent sample. **In its letter dated XX-YY-ZZZZ (Mlaaaaaaaa), the applicant responded that the exception in LRA section B.1.13.1 is revised to state, (Open Item)**

"The NUREG-1801 program states that approximately 10 percent of each type of penetration seal should be visually inspected at least once every refueling outage. The PNPS program specifies inspection of approximately 20 percent of the seals, including at least one seal of each type, each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every five operating cycles."

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On the basis that each type of seal will be included in each operating cycle, and since aging effects are typically manifested over several years, the project team found this exception acceptable.

The following addresses the new exception identified by the applicant in its letter dated **XX-YY-ZZZZ(MLaaaaaaaa).**

Exception 3

Element: 4. Detection of Aging Effects
Exception: The NUREG-1801 program recommends that functional testing and inspection of the Halon fire suppression system occur at least once every six months. However, PNPS performs inspections at least once every six months and conducts functional testing annually.

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

> Visual inspection of penetration seals detects cracking, seal separation from walls and components, and rupture and puncture of seals. Visual inspection by fire protection qualified inspectors of approximately 10 percent of each type of seal in walkdowns is performed at least once every refueling cycle. If any sign of degradation is detected within that sample, the scope of the inspection is expanded to include additional seals. Visual inspection by fire protection qualified inspectors of the fire barrier walls, ceilings, and floors, performed in walkdowns at least once every refueling outage ensures timely detection of concrete cracking, spalling, and loss of material. Visual inspection by fire protection qualified inspectors detects any sign of degradation of the fire door such as wear and missing parts. Periodic visual inspection and function tests detect degradation of the fire doors before there is a loss of intended function.
>
> Periodic tests are performed at least once every refueling outage, such as flow and discharge tests, sequential starting capability tests, and controller function tests performed on diesel-driven fire pump ensure fuel supply line performance. The performance tests detect degradation of the fuel supply lines before the loss of the component intended function. Visual inspections of the halon/$CO_2$ fire suppression system detect any sign of added degradation such as corrosion, mechanical damage, or damage to dampers. The periodic function test and inspection performed at least once every six months detects degradation of the halon/$CO_2$ fire suppression system before the loss of the component intended function.

The applicant stated that the variation in functional test frequency is insignificant with relation to detection of aging effects because functional tests are designed to verify the operability of active system components. Since system inspections are performed at least once every six months, aging effects are identified prior to loss of passive component intended function.

On the basis that inspections are performed at least once every six months, which does provide a better detection of passive intended function and is followed by a functional test once a year, the project team found this exception acceptable.

### 3.0.3.2.10.4 Enhancements

The applicant stated, in the PNPS LRA, that the enhancements in meeting the GALL Report program element are as follows:

Enhancement 1

Element: 3: Parameters Monitored/Inspected
6: Acceptance Criteria

Enhancement: Procedures will be enhanced to state that the diesel engine sub-systems (including the fuel supply line) shall be observed while the pump is running. Acceptance criteria will be enhanced to verify that the diesel engine did not exhibit signs of degradation while it was running such as fuel oil, lube oil, coolant, or exhaust gas leakage.

The GALL Report identified the following recommendations for the "Parameters Monitored/Inspected" and "Acceptance Criteria" program elements associated with the enhancement:



**Parameters Monitored/Inspected:** Visual inspection of approximately 10% of each type of penetration seal is performed during walkdowns carried out at least once every refueling outage. These inspections examine any sign of degradation such as cracking, seal separation from walls and components, separation of layers of material, rupture and puncture of seals, which are directly caused by increased hardness, and shrinkage of seal material due to weathering. Visual inspection of the fire barrier walls, ceilings, and floors examines any sign of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. Fire-rated doors are visually inspected on a plant-specific interval to verify the integrity of door surfaces and for clearances. The plant-specific inspection intervals are to be determined by engineering evaluation to detect degradation of the fire doors prior to the loss of intended function.

The diesel-driven fire pump is under observation during performance tests such as flow and discharge tests, sequential starting capability tests, and controller function tests for detection of any degradation of the fuel supply line.

The periodic visual inspection and function test is performed at least once every six months to examine the signs of degradation of the halon/$CO_2$ fire suppression system. Material conditions that may affect the performance of the system, such as corrosion, mechanical damage, or damage to dampers, are observed during these tests.

**Acceptance Criteria:** Inspection results are acceptable if there are no visual indications (outside those allowed by approved penetration seal configurations) of cracking, separation of seals from walls and components, separation of layers of material, or ruptures or punctures of seals; no visual indications of concrete cracking, spalling and loss of material of fire barrier walls, ceilings, and floors; no visual indications of missing parts, holes, and wear and no deficiencies in the functional tests of fire doors. No corrosion is acceptable in the fuel supply line for the diesel-driven fire pump. Also, any signs of corrosion and mechanical damage of the halon/$CO_2$ fire suppression system are not acceptable.

This enhancement is acceptable since this will make the program consistent with element 3 of the GALL AMP XI.M26 which states that the diesel fire pump is under observation during performance tests for detection of any degradation of fuel supply line. This enhancement is also acceptable since this will make the program consistent with element 6 of XI.M26 which states no corrosion is acceptable in the fuel supply line for the diesel driven fire pump. Procedure 8.B.22 was reviewed to confirm that these elements are consistent with the GALL Report.

On this basis, the project team found this enhancement acceptable since when enhancement is implemented, PNPS AMP B.1.13.1, "Fire Protection Program," will be consistent with GALL AMP XI.M26 and will provide additional assurance that the effects of aging will be adequately managed

Enhancement 2

Element: 3: Parameters Monitored/Inspected
6: Acceptance Criteria

Enhancement: The procedure for Halon system functional testing, will be enhanced to state that the Halon 1301 flex hoses shall be replaced if leakage occurs during the system functional test.

The GALL Report identified the following recommendations for the "Parameters Monitored/Inspected" and "Acceptance Criteria" program elements associated with the enhancement:

**Parameters Monitored/Inspected:** Visual inspection of approximately 10 percent of each type of penetration seal is performed during walkdowns carried out at least once every refueling outage. These inspections examine any sign of degradation such as cracking, seal separation from walls and components, separation of layers of material, rupture and puncture of seals, which are directly caused by increased hardness, and shrinkage of seal material due to weathering. Visual inspection of the fire barrier walls, ceilings, and floors examines any sign of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. Fire-rated doors are visually inspected on a plant-specific interval to verify the integrity of door surfaces and for clearances. The plant-specific inspection intervals are to be determined by engineering evaluation to detect degradation of the fire doors prior to the loss of intended function.

The diesel-driven fire pump is under observation during performance tests such as flow and discharge tests, sequential starting capability tests, and controller function tests for detection of any degradation of the fuel supply line.

The periodic visual inspection and function test is performed at least once every six months to examine the signs of degradation of the halon/$CO_2$ fire suppression system. Material conditions that may affect the performance of the system, such as corrosion, mechanical damage, or damage to dampers, are observed during these tests.

**Acceptance Criteria:** Inspection results are acceptable if there are no visual indications (outside those allowed by approved penetration seal configurations) of cracking, separation of seals from walls and components, separation of layers of material, or ruptures or punctures of seals; no visual indications of concrete cracking, spalling and loss of material of fire barrier walls, ceilings, and floors; no visual indications of missing parts, holes, and wear and no deficiencies in the functional tests of fire doors. No corrosion is acceptable in the fuel supply line for the diesel-driven fire pump. Also, any signs of corrosion and mechanical damage of the halon/$CO_2$ fire suppression system are not acceptable.

This enhancement is acceptable since this will make the program consistent with the acceptance criteria in GALL AMP XI.M26 which states that any signs of mechanical damage of the halon system are not acceptable.

On this basis, the project team found this enhancement acceptable since when enhancement is implemented, PNPS AMP B.1.13.1, "Fire Protection Program," will be consistent with GALL AMP XI.M26 and will provide additional assurance that the effects of aging will be adequately managed



3.0.3.2.10.5 Operating Experience

The applicant stated, in the PNPS LRA, that inspections of fire stops, fire barrier penetration seals, fire barrier walls, ceilings, and floors from 1998 through 2004, revealed signs of degradation such as cracks, gaps, voids, holes or missing material. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for fire barrier components.

Visual inspections and functional tests of fire doors, from 1998 through 2004, detected degradation of fire doors, such as corrosion, wear and missing parts. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing loss of material for fire doors.

Observation of the diesel-driven fire pump during a performance test in 2000 revealed leakage from the cooling system. The cause was determined to be corrosion of the heat exchanger shell, which was repaired. Observation of the diesel-driven fire pump during performance tests in 2001 revealed degradation of several components in the engine oil and coolant systems. The pump also failed a flow test. Therefore, the entire assembly (engine, controller, and pump) was replaced in 2002. Identification of degradation and corrective action provide evidence that the program is effective for managing aging of diesel-driven fire pump subsystem components.

Recent (2002 and 2003) visual inspections of cable spreading room Halon cylinders, associated hoses, valves and piping, detected no evidence of damage or corrosion. Absence of cracks or corrosion provides evidence that the program is effective for managing aging effects for cable spreading room Halon system components.

On July 31, 2003, NRC completed a triennial fire protection team inspection to assess whether PNPS has implemented an adequate fire protection program and that post-fire safe shutdown capabilities have been established and are being properly maintained at PNPS. Results confirmed that PNPS was maintaining the fire protection systems in accordance with their fire protection program and that PNPS was identifying program deficiencies and implementing appropriate corrective actions. The team also evaluated the material condition of fire walls, fire doors, fire dampers and fire barrier penetration seals and concluded that PNPS was maintaining passive features in a state of readiness.

A QA audit in May 2004 and an NRC inspection in June 2005 revealed no issues or findings that could impact effectiveness of the program to manage aging effects for fire protection components.

The project team reviewed the operating experience provided in the PNPS 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. The project team also reviewed Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.12, Fire Protection Program. The project team further reviewed CR-PNP-2000-0934 that was written to address cooling system leakage during the fire pump test of the diesel fire pump. The cause was determined to be degraded condition of the filler tube. Appropriate corrective action was taken.

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 concluded that the applicant's Fire Protection Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.10.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Fire Protection Program in PNPS LRA, Appendix A, Section A.1.12, which states that the Fire Protection Program includes a fire barrier inspection and a diesel-driven fire pump inspection. The fire barrier inspection 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 requires that the pump be periodically tested to ensure that the fuel supply line can perform its intended function. The program also includes periodic inspection and testing of the Halon fire suppression system.

Corrective actions, confirmation process, and administrative controls in accordance with the requirements of 10 CFR 50 Appendix B are applied to the Fire Protection Program.

During the audit and review the project team noted that the applicant's description of the Fire Protection Program in UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the enhancements described in LRA, Appendix B.1.13.1, Fire Protection. The project team asked the applicant to include a description of the enhancements to PNPS' Fire Protection Program in the UFSAR Supplement in LRA, Appendix A. In response to this request, the applicant stated that the program description in Appendix A will be revised to identify the commitment numbers associated with the enhancements for the Fire Protection Program as described in LRA Appendix B. The program description in Appendix A will be amended to include the following statement:

"License renewal commitment numbers A and B specify enhancements to this program."

This will require an amendment to the license renewal application. **{OPEN ITEM}**

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.13.1, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.10.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 FIRE WATER SYSTEM PROGRAM (PNPS AMP B.1.13.2)

In PNPS LRA, Appendix B, Section B.1.13.2, the applicant stated that PNPS AMP B.1.13.2, "Fire Water System Program," is an existing plant program that is consistent with GALL AMP XI.M27, "Fire Water System," with an exception and enhancements.

3.0.3.2.11.1 Program Description

The applicant stated, in the PNPS LRA, that this aging management program applies to water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, and aboveground and underground piping and components that are tested in accordance with applicable National Fire Protection Association (NFPA) codes and standards. Such testing assures functionality of systems. Also, many of these systems are normally maintained at required operating pressure and monitored such that leakage resulting in loss of system pressure is immediately detected and corrective actions initiated.

In addition, a sample of sprinkler heads will be inspected using the guidance of NFPA 25 (2002 Edition) Section 5.3.1.1.1. NFPA 25 states that, "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." NFPA 25 also contains guidance to perform this sampling every 10 years after initial field service testing.

3.0.3.2.11.2 <u>Consistency with the GALL Report</u>

In the PNPS LRA, the applicant stated that PNPS AMP B.1.13.2 is consistent with GALL AMP XI.M27, 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 audit and review report for PNPS AMP B.1.13.2, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.12.2, Fire Water System Program, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M27. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.13.2 and associated bases documents to determine consistency with GALL AMP XI.M27.

The project team also reviewed Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.13, Fire Water System Program; PNPS Procedure No. 8.B.3.1, Rev. 14, Fire Hose Station Equipment Inspection - FSAR Related Procedure; PNPS Procedure No. 8.B.6.1, Rev. 5, EDG A Pre-Action Sprinkler System Functional Test Procedure; PNPS Procedure No. 8.B.6.2, Rev. 6, EDG "Pre-Action Sprinkler System Functional Test Procedure; PNPS Procedure No. 8.B.6.8, Rev. 8, Recirc. Pump MG Set Oil Skid Pre-Action Sprinkler System Functional Test Procedure; PNPS Procedure No. 8.B.6.10, Rev. 5, Hydrogen Seal Oil Supply Pre-Action System Functional Test Procedure; PNPS Procedure No. 8.B.6.13, Rev. 4, Pre-Action Sprinkler System Water Flow Alarm Functional Test Procedure; PNPS Procedure No. 8.B.8, Rev. 16, Fire Hydrant Operability Procedure; PNPS Procedure No. 8.B.9.1, Rev. 4, Wet and Dry Pipe Sprinklers Main Drain Test Procedure; and PNPS Procedure No. 8.B.9.1.1, Rev. 5, Reactor Building Sprinklers Main Drain Test Procedure.

The project team reviewed those portions of the Fire Water System Program for which the applicant claims consistency with GALL AMP XI.M27 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's Fire Water System Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Fire Water System Program acceptable because it conforms to the recommended GALL AMP XI.M27, "Fire Water System," with the exception and enhancements as described below.

3.0.3.2.11.3 <u>Exceptions to the GALL Report</u>

<u>Exception</u>

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| Element | 4: Detection of Aging Effects |
| Exception: | NUREG-1801 specifies annual fire hydrant hose hydrostatic tests. Under the PNPS program, hydrostatic test of hoses occurs once per 3 years. NUREG-1801 specifies annual gasket inspections. Under the PNPS program, visual inspection, re-racking, and replacement of gaskets in couplings occurs at least once per operating cycle. NUREG-1801 specifies annual fire hydrant flow tests. Under the PNPS program, verification of operability and no-flow blockage occurs at least once every two fuel cycles. |

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

Fire protection system testing is performed to assure that the system functions by maintaining required operating pressures. Wall thickness evaluations of fire protection piping are performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections are performed before the end of the current operating term and at plant-specific intervals thereafter during the period of extended operation. As an alternative to non-intrusive testing, the plant maintenance process may include a visual inspection of the internal surface of the fire protection piping upon each entry to the system for routine or corrective maintenance, as long as it can be demonstrated that inspections are performed (based on past maintenance history) on a representative number of locations on a reasonable basis. These inspections must be capable of evaluating (1) wall thickness to ensure against catastrophic failure and (2) the inner diameter of the piping as it applies to the design flow of the fire protection system. If the environmental and material conditions that exist on the interior surface of the below-grade fire protection piping are similar to the conditions that exist within the above-grade fire protection piping, the results of the inspections of the above-grade fire protection piping can be extrapolated to evaluate the condition of below grade fire protection piping. If not, additional inspection activities are needed to ensure that the intended function of below-grade fire protection piping will be maintained consistent with the current licensing basis for the period of extended operation. Continuous system pressure monitoring, system flow testing, and wall thickness evaluations of piping are effective means to ensure that corrosion and biofouling are not occurring and the system's intended function is maintained.

General requirements of existing fire protection programs include testing and maintenance of fire detection and protection systems and surveillance procedures to ensure that fire detectors as well as fire protection systems and components are operable.

Visual inspection of yard fire hydrants performed annually in accordance with NFPA 25 ensures timely detection of signs of degradation, such as corrosion. Fire hydrant hose hydrostatic tests, gasket inspections, and fire hydrant flow tests, performed annually, ensure that fire hydrants can perform their intended function and provide opportunities for degradation to be detected before a loss of intended function can occur.

Sprinkler heads are inspected before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

The applicant stated, in the PNPS LRA, that since aging effects are typically manifested over several years, differences in inspection and testing frequencies are insignificant. The project team reviewed LRPD-05, Operating Experience Review Report, to determine any age-related issues with fire water system components. The review determined a few instances of age related degradation over the last 5 years. However, these were all picked up by the program.

The project team found these frequencies are reasonable and adequate to manage the aging effects. On this basis, the project team found this exception acceptable.

3.0.3.2.11.4 Enhancements

The applicant stated, in the PNPS LRA, that the enhancements in meeting the GALL Report program elements are as follows:

Enhancement 1

| | |
|---|---|
| Elements: | 3: Parameters Monitored/Inspected<br>6: Acceptance Criteria |
| Enhancement: | Procedures will be enhanced to include inspection of hose reels for corrosion. Acceptance criteria will be enhanced to verify no significant corrosion. |



The GALL Report identified the following recommendations for the "Parameters Monitored/Inspected" and "Acceptance Criteria" program elements associated with the enhancement:

**Parameters Monitored/Inspected:** 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. Periodic flow testing of the fire water system is performed using the guidelines of NFPA 25, or wall thickness evaluations may be performed to ensure that the system maintains its intended function.

This enhancement is acceptable since this will make the program consistent with GALL AMP XI.M27, element 3.

**Acceptance Criteria:** The acceptance criteria are (a) the ability of a fire protection system to maintain required pressure, (b) no unacceptable signs of degradation observed during non-intrusive or visual assessment of internal system conditions, and (c) that no biofouling exists in the sprinkler systems that could cause corrosion in the sprinkler heads.

This enhancement is acceptable since this will make the program consistent with GALL AMP XI.M27, element 6.

On this basis, the project team found this enhancement acceptable since when enhancements are implemented, PNPS AMP B.1.13.2, "Fire Water System Program," will be consistent with GALL AMP XI.M27 and will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

Element: 4: Detection of Aging Effects
Enhancement: A sample of sprinkler heads will be inspected using guidance of NFPA 25 (2002 Edition) Section 5.3.1.1.1. NFPA 25 also contains guidance to repeat this sampling every 10 years after initial field service testing.

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the enhancement:

Fire protection system testing is performed to assure that the system functions by maintaining required operating pressures. Wall thickness evaluations of fire protection piping are performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections are performed before the end of the current operating term and at plant-specific intervals thereafter during the period of extended operation. As an alternative to non-intrusive testing, the plant maintenance process may include a visual inspection of the internal surface of the fire protection piping upon each entry to the system for routine or corrective maintenance, as long as it can be demonstrated that inspections are performed (based on past maintenance history) on a representative number of locations on a reasonable basis. These inspections must be capable of evaluating (1) wall thickness to ensure against catastrophic failure and (2) the inner diameter of the piping as it applies to the design flow of the fire protection system. If the environmental and material conditions that exist on the interior surface of the below grade fire protection piping are similar to the conditions that exist within the above grade fire protection piping, the results of the inspections of the above grade fire protection piping can be extrapolated to evaluate the condition of below grade fire protection piping. If not, additional inspection activities are needed to ensure that the intended function of below grade fire protection piping will be maintained consistent with the current licensing basis for the period of extended operation. Continuous system pressure monitoring, system flow testing, and wall thickness evaluations of piping are effective means to ensure that corrosion and biofouling are not occurring and the system's intended function is maintained.

General requirements of existing fire protection programs include testing and maintenance of fire detection and protection systems and surveillance procedures to ensure that fire detectors, as well as fire protection systems and components are operable.

Visual inspection of yard fire hydrants performed annually in accordance with NFPA 25 ensures timely detection of signs of degradation, such as corrosion. Fire hydrant hose hydrostatic tests, gasket inspections, and fire hydrant flow tests, performed annually, ensure that fire hydrants can perform their intended function and provide opportunities for degradation to be detected before a loss of intended function can occur.

> Sprinkler heads are inspected before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

This enhancement is acceptable since this will make the program consistent with GALL AMP XI.M27, element 4.

On this basis, the project team found this enhancement acceptable since when enhancement is implemented, PNPS AMP B.1.13.2, "Fire Water System Program," will be consistent with GALL AMP XI.M27 and will provide additional assurance that the effects of aging will be adequately managed.

<u>Enhancement 3</u>

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Enhancement: | Wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function. |



The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the enhancement:

> Fire protection system testing is performed to assure that the system functions by maintaining required operating pressures. Wall thickness evaluations of fire protection piping are performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections are performed before the end of the current operating term and at plant-specific intervals thereafter during the period of extended operation. As an alternative to non-intrusive testing, the plant maintenance process may include a visual inspection of the internal surface of the fire protection piping upon each entry to the system for routine or corrective maintenance, as long as it can be demonstrated that inspections are performed (based on past maintenance history) on a representative number of locations on a reasonable basis. These inspections must be capable of evaluating (1) wall thickness to ensure against catastrophic failure and (2) the inner diameter of the piping as it applies to the design flow of the fire protection system. If the environmental and material conditions that exist on the interior surface of the below grade fire protection piping are similar to the conditions that exist within the above grade fire protection piping, the results of the inspections of the above grade fire protection piping can be extrapolated to evaluate the condition of below grade fire protection piping. If not, additional inspection activities are needed to ensure that the intended function of below grade fire protection piping will be maintained consistent with the current licensing basis for the period of extended operation. Continuous system pressure monitoring, system flow

testing, and wall thickness evaluations of piping are effective means to ensure that corrosion and biofouling are not occurring and the system's intended function is maintained.

General requirements of existing fire protection programs include testing and maintenance of fire detection and protection systems and surveillance procedures to ensure that fire detectors, as well as fire protection systems and components are operable.

Visual inspection of yard fire hydrants performed annually in accordance with NFPA 25 ensures timely detection of signs of degradation, such as corrosion. Fire hydrant hose hydrostatic tests, gasket inspections, and fire hydrant flow tests, performed annually, ensure that fire hydrants can perform their intended function and provide opportunities for degradation to be detected before a loss of intended function can occur.

Sprinkler heads are inspected before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

This enhancement is acceptable since this will make the program consistent with GALL AMP XI.M27, element 4.

On this basis, the project team found this enhancement acceptable since when enhancement is implemented, PNPS AMP B.1.13.2, "Fire Water System Program," will be consistent with GALL AMP XI.M27 and will provide additional assurance that the effects of aging will be adequately managed.



3.0.3.2.11.5 <u>Operating Experience</u>

The applicant stated, in the PNPS LRA, that a fire hose station inspection in 1999 identified a degraded hose station. The hose reel was replaced. Hydrostatic testing and visual inspections of fire hose station equipment in 2004 and 2005 revealed no loss of material. Absence of significant corrosion provides evidence that the program is effective for managing loss of material for fire water system components.

Inspection of fire water storage tank, T-107A, in 2001 revealed minimal localized leakage, probably due to loss of material on the tank bottom. The leakage is being monitored and repair is scheduled. Also, inspection of fire water storage tank, T-107B, in 2003 revealed that microbiologically influenced corrosion (MIC) is occurring at spots (<1/16" in diameter) on internal surfaces. Similar corrosion was seen prior to tank recoating in 1993. Results of the next inspection (2008) will be compared with 2003 results to determine the need for repair of the tank. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing loss of material for fire water system components. Full flow tests of fire main segments and hydrant inspections from 2001 through 2004 found no evidence of obstruction or loss of material. Spray and sprinkler system functional tests, and visual inspections of piping and nozzles, in 2003 found no evidence of blockage or loss of material. Confirmation of absence of degradation provides evidence that the program is effective for managing loss of material for fire water system components.

In 2001, an underground fire main broke due to fabrication and installation anomalies. A 16' section of the pipe was replaced. Inspection of internal and external surfaces of the removed pipe section revealed only one small spot of corrosion on the external surface where the coating was cracked. Confirmation of absence of degradation provides evidence that the program is effective for managing loss of material for fire water system components.

On July 31, 2003, NRC completed a triennial fire protection team inspection to assess whether PNPS has implemented an adequate fire protection program and that post-fire safe shutdown capabilities have been established and are being properly maintained at PNPS. Results confirmed that PNPS was maintaining the fire protection systems in accordance with their fire protection program and that PNPS was identifying program deficiencies and implementing appropriate corrective actions. The team also evaluated the material condition of selected wet pipe sprinkler systems, standpipe systems, and hose reels and concluded that PNPS was maintaining passive features in a state of readiness.

A QA audit in May 2004 revealed no issues or findings that could impact effectiveness of the program to manage loss of material for fire water system components.

The project team reviewed the operating experience provided in the PNPS 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. The project team also reviewed Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.13, Fire Water System Program. The project team further reviewed CR-PNP-2001-09700 that addresses the inspection of the fire water storage tank discussed above. The project team confirmed that appropriate corrective actions were identified and completed.

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 concluded that the applicant's Fire Water System Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.11.6 <u>UFSAR Supplement</u>

The applicant provided its UFSAR Supplement for the Fire Water System Program in PNPS LRA, Appendix A, Section A.2.1.14, which states that the Fire Water System Program applies to water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, and aboveground and underground piping and components that are tested in accordance with applicable National Fire Protection Association (NFPA) codes and standards. Such testing assures functionality of systems. To determine if significant corrosion has occurred in water-based fire protection systems, periodic flushing, system performance testing and inspections are conducted. Also, many of these systems are normally maintained at required operating pressure and monitored such that leakage resulting in loss of system pressure is immediately detected and corrective actions initiated.

In addition, wall thickness evaluations of fire protection piping are periodically performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion.

A sample of sprinkler heads will be inspected using the guidance of NFPA 25 (2002 Edition) Section 5.3.1.1.1, which 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." This sampling will be repeated every 10 years after initial field service testing.

During the audit and review, the project team noted that the applicant's description of the Fire Water System Program in UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the enhancements described in LRA, Appendix B.1.13.2, Fire Water System. The project team asked the applicant to include a description of the enhancements to PNPS' Fire Water System Program in the UFSAR Supplement in LRA, Appendix A. In response to this request, the applicant stated that the program description in Appendix A will be revised to identify the commitment numbers associated with the enhancements for the Fire Water System Program as described in LRA Appendix B. The program description in Appendix A will be amended to include the following statement:

> "License renewal commitment numbers C, D, and E specify enhancements to this program."



This will require an amendment to the license renewal application. {OPEN ITEM}

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.13.2, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.11.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 METAL-ENCLOSED BUS INSPECTION PROGRAM (PNPS AMP B.1.18)

In PNPS LRA, Appendix B, Section B.1.18, the applicant stated that PNPS AMP B.1.18, "Metal-

Enclosed Bus Inspection Program," is a new plant program that is consistent with GALL AMP XI.E4, "Metal-Enclosed Bus," with exceptions.

3.0.3.2.12.1 Program Description

The applicant stated, in the PNPS LRA, that this program will manage the effects of aging on non-segregated phase bus which connects the 4.16 kV switchgear (A3 through A6) through visual inspection of enclosure assemblies and interior portions of the bus. This inspection will also verify the absence of water or debris.

The program will be initiated prior to the period of extended operation.

3.0.3.2.12.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.18 is consistent with GALL AMP XI.E4, 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 audit and review report for PNPS AMP B.1.18, including LRPD-02, Revision 1, Section 3.3, "Metal-Enclosed Bus Inspection Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.E4. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.18 and associated bases documents to determine consistency with GALL AMP XI.E4.

The project team also reviewed AMRE-01, Rev. 2, "Electrical Screening and Aging Management Reviews."

The project team reviewed those portions of the Metal-Enclosed Bus Inspection Program for which the applicant claims consistency with GALL AMP XI.E4 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Metal-Enclosed Bus Inspection Program provides reasonable assurance that aging effects of metal-enclosed bus caused by cracked insulation, moisture or debris in the bus enclosure, and loosening of bolted connections will be managed to be consistent with CLB during the extended period of operation. The project team found the applicant's Metal-Enclosed Bus Inspection Program acceptable because it conforms to the recommended GALL AMP XI.E4, "Metal-Enclosed Bus," with exceptions as described below.

3.0.3.2.12.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exceptions to the GALL Report program elements are as follows:

Exception 1

Elements: 3: Parameters Monitored/Inspected

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4: Detection of Aging Effects

Exception: Metal-Enclosed Bus (MEB) enclosure assemblies will be inspected in addition to internal surfaces.

The GALL Report identified the following recommendations for the "Parameters Monitored/Inspected" and "Detection of Aging Effects" program elements associated with the exception taken:

> **Parameters Monitored/Inspected:** A sample of accessible bolted connections will be checked for loose connection. Alternatively, bolted connections covered with heat shrink tape, sleeving, insulating boots, etc., may be visually inspected for insulation material surface anomalies. This program provides for the inspection of the internal portion of the MEBs for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The bus insulation will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The internal bus supports will be inspected for structural integrity and signs of cracks.
>
> **Detection of Aging Effects:** A sample of accessible bolted connections will be checked for loose connection by using thermography or by measuring connection resistance using a low-range ohmmeter. MEB internal surfaces will be visually inspected for aging degradation of insulating material and for foreign debris and excessive dust buildup, and evidence of moisture intrusion. Bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. Internal bus supports will be visually inspected for structural integrity and signs of cracks. This program will be completed before the period of extended operation and every 10 years thereafter provided visual inspection is not used to check bolted connections. A 10-year inspection interval will provide two data points during a 20-year period, which can be used to characterize the degradation rate. This is an adequate period to preclude failures of the MEBs since experience has shown that aging degradation is a slow process.
>
> As an alternative to thermography or measuring connection resistance of bolted connections, for the accessible bolted connections that are covered with heat shrink tape, sleeving, insulating boots, etc., the applicant may use visual inspection of insulation material to detect surface anomalies, such as discoloration, cracking, chipping or surface contamination. When this alternative visual inspection is used to check bolted connections, the first inspection will be completed before the period of extended operation and every five years thereafter.

The applicant stated in the PNPS LRA, under Exception 1, that inspection of MEB enclosure under the Metal-Enclosure Bus Inspection Program assures that effects of aging will be identified prior to loss of intended functions.

The GALL Report (NUREG-1801, Rev. 1, Section VI, Items VI.A-12 and VI-13) referred to the Structure Monitoring Program for inspecting the external of MEB for loss of material due to general corrosion and inspecting the enclosure seals for hardening and loss of strength due to elastomers degradation. In LRA, Section B.1.18, the applicant stated that the program attribute of the MEB inspection programwould be consistent with the programattribute in NUREG-1801, Section XI.E4, with an exception. The exception is to inspect MEB enclosure assemblies in addition to internal surfaces using the MEB inspection program. The project team asked the applicant if the enclosure seals were included in the scope of the MEB inspection program and what was the acceptance criteria for inspecting the external of enclosure assemblies. **In a letter dated... (ML...)**, the applicant respondedthat the PNPS MEB programwill visually inspect the enclosure assemblies for evidence of loss of material, and enclosure assembly elastomers will be visually inspected and manually flexed. The applicant will revise LRPD-02to read as follows:

> The acceptance criteria for enclosure assemblies will be no loss of material due to general corrosion. The acceptance criteria for elastomers will be no hardening and loss of strength due to degradation.

The project team found that the applicant's response acceptable because it will inspect the external of MEBs including seals, and the acceptance criteria for the inspecting the components of the external of MEBs will be provided in the plant's basis document (LRPD). On this basis, the project team found this exception acceptable.

<u>Exception 2</u>



| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Exception: | MEB bolted connections will be visually inspected every 10 years rather than every 5 years as stated in NUREG-1801. |

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

> **Detection of AgingEffects:** A sample of accessible bolted connections will be checked for loose connection by using thermographyor by measuring connection resistance using a low-range ohmmeter. MEB internal surfaces will be visually inspected for aging degradation of insulating material and for foreign debris and excessive dust buildup, and evidence of moisture intrusion. Bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. Internal bus supports will be visually inspected for structural integrity and signs of cracks. This program will be completed before the period of extended operation and every 10 years thereafter provided visual inspection is not used to check bolted connections. A 10-year inspection interval will provide two data points during a 20-year period, which can be used to characterize the degradation rate. This is an adequate period to preclude failures of the MEBs since experience has shown that aging degradation is a slow process.
>
> As an alternative to thermographyor measuring connection resistance of bolted connections, for the accessible bolted connections that are covered with heat shrink tape, sleeving, insulating boots, etc., the applicant may use visual inspection of insulation material to detect surface anomalies, such as discoloration, cracking, chipping or surface contamination. When this alternative visual inspection is used to check bolted connections,

the first inspection will be completed before the period of extended operation and every five years thereafter.

The applicant stated, in the PNPS LRA under Foot Note 2, that in NUREG-1801 for the other inspections, a 10-year inspection interval will provide two data points during a 20-year period which can be used to characterize the degradation rate. This is an adequate period to preclude failures of the MEBs because experience has shown that aging degradation is a slow process.

GALL AMP XI.E4 states that the applicant may use visual inspection of insulation material to detect surface anomalies (such as discoloration, cracking, chipping, or surface contamination) for the accessible bolted connections that are covered with heat shrink tape, sleeving, insulated boots, etc. Visual inspection is used as an alternate to thermography or measuring connection resistance of bolted connections. This alternate visual inspection is less effective than testing. For this reason, when visual inspection is used to check bolted connections, the first inspection will be completed before the period of extended operation and performed once every 5 years instead of once every 10 years.

In the LRA, the applicant stated that visual inspection of MEB bolted connections will occur every 10 years. The project team asked the applicant if all bolted connections are covered with heat shrink tape, sleeving, or insulated boots and requested the applicant to justify the 10 years inspection frequency vs. the 5 years as recommended by GALL XI.E4. **In a letter dated... (ML...)**, the applicant responded that since MEB bolted connections are covered with heat shrink tape or insulating boots per manufacturer's recommendations, a sample of accessible bolted connections will be visually inspected for insulation material surface anomalies. Internal portions of the MEBs will be inspected for cracks, corrosion, foreign debris, excessive bust buildup, and evidence of water intrusion. Bus insulation will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. Internal bus supports will be inspected for structural integrity and signs of cracking. An inspection will occur before the initial 40-year license term and every 5 years thereafter. If degradation is found in the MEB materials, an engineering evaluation will be performed when the inspection acceptance criteria are not met to ensure that the intended functions of the MEB can be maintained consistent with the current license basis. This evaluation is performed in accordance with the Entergy correction process per procedure EN-LI-102. This procedure provides the stated elements to consider including the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective action required, and likelihood of recurrence. This engineering evaluation will determine the frequency of the next inspection, which will not exceed five years. In addition, the applicant also responded that it will revise LRA Appendix B.2.1.20 to "five years." Revise LRA Appendix B.1.18 to remove the exception to five years. On this basis, the project team found the applicant response acceptable.

3.0.3.2.12.4 Enhancements

None.

3.0.3.2.12.5 Operating Experience

The applicant stated, in the PNPS LRA, that the Metal-Enclosed Bus Inspection Program at PNPS is a new programfor which there is no operating experience.

GALL XI.E4 indicates that operating experience has shown that degradation of MEB within the scope of XI.E4 may exist. The project team requested the applicant to provide industrial and plant operating experience associated with this program. **In a letter dated... (ML...), the applicant responded that...**

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Metal-Enclosed Bus Inspection Programwill adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.12.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Metal-Enclosed Bus Inspection Program in PNPS LRA, Appendix A, Section A.2.1.20, which states that under the Metal-Enclosed Bus Inspection Program, internal portions of the nonsegregated phase bus which connects the 4.16kV switchgear (A3 through A6) are inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. Bus insulation is inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. Internal bus supports are inspected for structural integrity and signs of cracks. Since bolted connections are covered with heat shrink tape or insulating boots per manufacturer's recommendations, a sample of accessible bolted connections is visually inspected for insulation material surface anomalies. Enclosure assemblies are visually inspected for evidence of loss of material and, where applicable, enclosure assembly elastomers are visually inspected and manually flexed to manage cracking and change in material properties. These inspections are performed at least once every 10 years.

As described above, the applicant will revise UFSAR, Appendix A.2.1.20 to "five years." The project team reviewed the revised UFSAR Supplement for PNPS AMP B.1.18, 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 FSAR supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.12.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those programelements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 OIL ANALYSIS PROGRAM (PNPS AMP B.1.22)

In PNPS LRA, Appendix B, Section B.1.22, the applicant stated that PNPS AMP B.1.22, "Oil Analysis Program," is an existing plant program that is consistent with GALL AMP XI.M39, "Lubricating Oil Analysis," with an exception and enhancements..

3.0.3.2.13.1 Program Description

The applicant stated, in the PNPS LRA, that this program maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to loss of material, cracking, or fouling. Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results.

3.0.3.2.13.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.22 is consistent with GALL AMP XI.M39, 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 audit and review report for PNPS AMP B.1.22, including PNPS AMP B.1.22, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.16, "Oil Analysis Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M39. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.22 and associated bases documents to determine consistency with GALL AMP XI.M39.

The project team also reviewed PNPS License Renewal Project Operating Experience Review Report, LRPD-05, Section 4.16, "Oil Analysis Program;" Entergy Nuclear Management Manual, Predictive Maintenance Program, EN-DC-310, Rev. 0; CR-PNP-2003-02670, During Lube Oil Analysis Evaluation for RHR Pump B (P-203B) the Viscosity Was Noted to be Slightly Outside of the Acceptable Range; CR-PNP-2005-00116, Lube Oil Testing of the A Diesel X-107A Has Indicated a Step Change in the Wear Particle Count; CR-PNP-2005-00613, Lube Oil Testing of the B Diesel X-107B Has Indicated a Step Change in the Wear Particle Count.

The project team reviewed those portions of the Oil Analysis Program for which the applicant claims consistency with GALL AMP XI.M39 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's Oil Analysis Program provides reasonable assurance that the effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Oil

Analysis Program acceptable because it conforms to the recommended GALL AMP XI.M22, "Lubricating Oil Analysis," with an exception and enhancements as described below.

3.0.3.2.13.3 <u>Exceptions to the GALL Report</u>

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

Element: 3: Parameters Monitored/Inspected
Exception: Flash point is not determined for sampled oil.

The GALL Report identified the following recommendation for the "Parameters Monitored/Inspected" program element associated with the exception taken:

> For components with periodic oil changes in accordance with manufacturer's recommendations, a particle count and check for water are performed to detect evidence of abnormal wear rates, contamination by moisture, or excessive corrosion. For components that do not have regular oil changes, viscosity, neutralization number, and flash point are also determined to verify the oil is suitable for continued use. In addition, analytical ferrography and elemental analysis are performed to identify wear particles.

The applicant stated, in the PNPS LRA, that analyses of filter residue or particle count, viscosity, total acid/base (neutralization number), water content, and metals content provide sufficient information to verify the oil is suitable for continued use.

During the audit and review, the project team asked the applicant to provide justification for not monitoring the flashpoint of oil that is not regularly changed. In its response to this request, the applicant stated that flash point is not determined for sample oil because analysis of filter residue or particle count, viscosity, total acid/base (neutralization number), water content, and metals content provide sufficient information to verify the oil does not contain water or contaminants that would permit the onset of aging effects: Also, the applicant stated that the percent fuel dilution in diesel engine oils is monitored, which is a more accurate method than flash point for identifying fuel leak and oil dilution. Subsequently, the project team asked the applicant to provide the method, including any standards, used to determine fuel dilution and the acceptance criterion for oil dilution in diesel engine oils.

In its response to this request, the applicant provided a copy of procedure 3.M.3-61.3, Emergency Diesel Generator Quarterly Preventive Maintenance, showing that quarterly lube oil samples are sent to the laboratory. Provided laboratory test results showing that percent dilution is measured in accordance with ASTM standards. Acceptance criterion is less than 3 percent by weight and based on ALCO diesel engine owners' group chemistry guidelines. The following will be added to LRA Section B.1.22 exception note. PNPS measures the percent fuel dilution in diesel engine oils, which is a more accurate method than flash point for identifying fuel leaks and oil dilution. This requires an amendment to the LRA.

On this basis, the project team found this exception acceptable.

3.0.3.2.13.4 Enhancements

The applicant stated, in the PNPS LRA, that the enhancements in meeting the GALL Report program elements are as follows:

Enhancement 1

| | |
|---|---|
| Elements: | 1: Scope of Program |
| Enhancement: | The Oil Analysis Program will be enhanced to periodically change CRD pump lubricating oil. A particle count and check for water will be performed on the drained oil to detect evidence of abnormal wear rates, contamination by moisture, or excessive corrosion. |

The GALL Report identified the following recommendation for the "Scope of Program" program element associated with the enhancement:

**Scope of Program:** On a periodic basis, this program samples lubricating oil from plant components subject to aging management review.

The applicant stated, in the PNPS LRA, that this enhancement will be initiated prior to the period of extended operation. The implementation of this enhancement by the applicant will verify that the oil environment of the CRD pump will not be conducive to loss of material thus providing additional assurance that loss of material will be adequately managed.

On this basis, the project team found this enhancement acceptable because when enhancements are implemented, PNPS AMP B.1.22, "Oil Analysis Program," will be consistent with GALL AMP XI.M39 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

| | |
|---|---|
| Element: | 3: Parameter Monitored/Inspected |
| Enhancement | Procedures for security diesel and reactor water cleanup pump oil changes will be enhanced to obtain oil samples from the drained oil. Procedures for lubricating oil analysis will be enhanced to specify that a particle count and check for water are performed on oil samples from the fire water pump diesel, security diesel, and reactor water cleanup pumps. |

The GALL Report identified the following recommendation for the "Parameter Monitored/Inspected" program element associated with the enhancement:

**Parameters Monitored/Inspected:** For components with periodic oil changes in accordance with manufacturer's recommendations, a particle count and check for water are performed to detect evidence of abnormal wear rates, contamination by moisture, or excessive corrosion. For components that do not have regular oil changes, viscosity, neutralization number, and flash point are also determined to verify the oil is suitable for continued use. In addition, analytical ferrography and elemental analysis are performed to identify wear particles.

The applicant stated, in the PNPS LRA, that this enhancement will be initiated prior to the period of extended operation. The implementation of this enhancement by the applicant will verify that the oil environment of the fire water pump diesel, security diesel, and reactor water cleanup pumps will not be conducive to loss of material thus providing additional assurance that loss of material will be adequately managed.

On this basis, the project team found this enhancement acceptable since when enhancement is implemented, PNPS AMP B.1.22, "Oil Analysis Program," will be consistent with GALL AMP XI.M39 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.2.13.5 Operating Experience

The applicant stated, in the PNPS LRA, that lube oil analysis for residual heat removal pump B in July 2003 showed viscosity slightly outside of the acceptable range. No other problems were noted with the oil. Retest confirmed the viscosity condition. The oil was changed at the next system window. Continuous confirmation of oil quality and timely corrective actions provide evidence that the program is effective in managing aging effects for lube oil components.

Lube oil testing of the A diesel generator in December 2004 and of the B diesel generator in January 2005 indicated a step change in the wear particle count. The increase in iron and aluminum was very minor and levels remained well below those at which corrective action is necessary. The analysis laboratory indicated that the increases may be the result of new analysis equipment that has a higher resolution. Quarterly trending will continue for wear products and appropriate action will be taken if required. Continuous confirmation of oil quality and timely corrective actions provide evidence that the program is effective in managing aging effects for lube oil components.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the Oil Analysis Program and did not find any evidence of PNPS component degradation or failures that are outside the envelope of 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 concluded that the applicant's Oil Analysis Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.13.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Oil Analysis Program in PNPS LRA,

Appendix A, Section A.2.1.24, which states that the Oil Analysis Program maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to loss of material, cracking, or fouling. Activities include sampling and analysis of lubricating oil for detrimental contaminants, water, and particulates.

Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results.

During the audit and review, the project team noted that the applicant's description of the B.1.22 program in UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the enhancements described in LRA, Appendix B.1.22. The project team asked the applicant to include a description of the enhancements to PNPS' B.1.22 program in the UFSAR Supplement in LRA Appendix A as recommended by NUREG-1800, Section 3.X.2.4. In response to this request, the applicant stated that program description in Appendix A will be revised to identify the commitment number(s) associated with the enhancement(s) for that program as described in LRA Appendix B. The program description in Appendix A will be amended to include the following statement:

> License renewal commitment numbers 18 and 19 specify enhancements to this program.

This will require an amendment to the license renewal application. **(Open Item).**

When PNPS officially issues the commitment list and the revised write-up, the appropriate commitment number should be inserted above.

On this basis, the project team found this enhancement acceptable because when the enhancement is implemented, PNPS AMP B.1.22, "Oil Analysis Program," will be consistent with GALL AMP XI.M39 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.2.13.7 <u>Conclusion</u>

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 <u>REACTOR HEAD CLOSURE STUDS PROGRAM (PNPS AMP B.1.25)</u>

In PNPS LRA, Appendix B, Section B.1.25, the applicant stated that PNPS AMP B.1.25, "Reactor Head Closure Studs Program," is an existing plant program that is consistent with GALL AMP XI.M3, "Reactor Head Closure Studs," with an exception.

3.0.3.2.14.1 Program Description

The applicant stated, in the PNPS LRA, that this program includes inservice inspection (ISI) in conformance with the requirements of ASME Section XI, Subsection IWB, and preventive measures (e.g. rust inhibitors, stable lubricants, appropriate materials) to mitigate cracking and loss of material of reactor head closure studs, nuts, washers, and bushings.

3.0.3.2.14.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.25 is consistent with GALL AMP XI.M3, 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 audit and review report for PNPS AMP B.1.25, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.18, "Reactor Head Closure Studs Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M3. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.25 and associated bases documents to determine consistency with GALL AMP XI.M3.

The project team also reviewed PNPS Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.20, "Reactor Head Closure Studs Program;" ASME Section XI, 2001 edition with 2002 and 2003 addenda, Table IWB-2500-1; ASME Section XI, 1995 edition with 1996 addenda, Table IWB-2500-1.

The project team reviewed those portions of the Reactor Head Closure Studs Program for which the applicant claims consistency with GALL AMP XI.M3 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's Reactor Head Closure Studs Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Reactor Head Closure Studs Program acceptable because it conforms to the recommended GALL AMP XI.M3, "Reactor Head Closure Studs," with the exception as described below.

3.0.3.2.14.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

Exception

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Element: 4: Detection of Aging Effects
Exception: When reactor head closure studs are removed for examination, either a surface or a volumetric examination is allowed.

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

> The extent and schedule of the inspection and test techniques prescribed by the program are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of the component. Inspection can reveal cracking, loss of material due to corrosion or wear, and leakage of coolant.
>
> The program uses visual, surface, and volumetric examinations in accordance with the general requirements of Subsection IWA-2000. Surface examination uses magnetic particle, liquid penetration, or eddy current examinations to indicate the presence of surface discontinuities and flaws. Volumetric examination uses radiographic or ultrasonic examinations to indicate the presence of discontinuities or flaws throughout the volume of material. Visual VT-2 examination detects evidence of leakage from pressure-retaining components, as required during the system pressure test.
>
> Components are examined and tested as specified in Table IWB-2500-1. Examination category B-G-1 for pressure-retaining bolting greater than 2 in. diameter in reactor vessels specifies volumetric examination of studs in place, from the top of the nut to the bottom of the flange hole, and surface and volumetric examination of studs when removed. Also specified are volumetric examination of flange threads and visual VT-1 examination of surfaces of nuts, washers, and bushings. Examination category B-P for all pressure-retaining components specifies visual VT-2 examination of all pressure-retaining boundary components during the system leakage test and the system hydrostatic test.

The applicant stated, in the PNPS LRA, that cracking initiates on the outside surfaces of bolts and studs. Therefore, a qualified surface examination meeting the acceptance standards of ASME Section XI, Subsection IWB-3515 provides at least the sensitivity for flaw detection that an end-shot ultrasonic examination provides on bolts and studs. Thus, when reactor head closure studs are removed for examination, either a surface or volumetric examination is allowed.

During the audit and review, the project team asked the applicant, with regard to reactor head closure studs that are removed, whether the surface examination of the studs is performed with the studs in a tensioned or untensioned condition. The project team also asked the applicant whether PNPS has performed any radial ultrasonic scans of its reactor vessel closure studs. In response to these requests, the applicant provided the following statements:

> Since refueling outage 15 (RFO15) (2005), PNPS has adopted the 1998 edition with 2000 addenda of ASME Section XI, which requires either a surface exam or a volumetric exam of RPV studs that are removed. PNPS elected to perform a volumetric examination of these four studs in RFO15 in the tensioned condition prior to their removal. No indications were detected in the four removed studs in 2005. The four studs adjacent to the fuel transfer

chute are removed at each refueling outage; these are the only studs that have been removed from the PNPS vessel.

PNPS currently performs ultrasonic examination of RPV studs from the top surface of the stud. In the past, PNPS had performed this examination using a specially fabricated stud radial ultrasonic testing (UT) probe inserted into the stud's heater hole located on the stud's central axis. The technique currently in use, utilizing the flat surface at the top of the stud, is considered superior in detection of flaws in RPV studs when compared to UT exams performed from the heater hole.

RPV studs at PNPS are examined utilizing a straight beam UT technique. This method has been demonstrated and qualified by the Performance Demonstration Initiative (PDI) at the Electric Power Research Institute (EPRI) Nondestructive Examination (NDE) Center. Examiners utilizing this qualified technique are also qualified by the PDI to perform this examination. This straight beam examination has been demonstrated by PDI to be capable of detecting a flaw of critical size. All 56 RPV studs at PNPS are examined once per interval using this technique.

The project team reviewed the ASME Section XI requirements for Examination Category B-G-1, pressure retaining bolting, in the 1995 code edition, which was referenced in Revision 0 of the GALL Report and in the 2001 code edition, which is referenced in Revision 1 of the GALL Report. The project team noted that code examination requirements were changed from the earlier code edition to the more recent code edition so that the 2001 code edition with 2002 and 2003 addenda, on which the current revision of the GALL Report is based, no longer requires both surface and volumetric examination of reactor vessel closure studs, when removed. On the basis that the applicant's requirement to perform either surface or volumetric examination of reactor vessel closure studs (when removed) is consistent with the ASME Section XI code edition and addenda referenced in the GALL Report, Revision 1, the project team found the exception identified by the applicant to be acceptable. On this basis, the project team found this exception acceptable.

3.0.3.2.14.4 Enhancements

None.

3.0.3.2.14.5 Operating Experience

The applicant stated, in the PNPS LRA, that volumetric examination of 18 reactor head closure studs and visual examination of 18 nuts and 18 washers during RFO15 (April 2005) resulted in no new recordable indications. Absence of new recordable indications provides evidence that the program is effective for managing loss of material and cracking of the reactor head closure studs, nuts, washers, and bushings.

During the audit and review, the project team asked the applicant what fraction of the total number of reactor head closure studs is represented by the 18 studs examined during RFO15. The project team also asked whether all reactor head closure studs, nuts, and washers are examined during each 10-year ISI interval and whether the currently installed studs, nuts, and washers are original equipment that has been in use since startup of the plant. In response to this request, the applicant provided the following information:

> There are 56 reactor head studs, so a sample of 18 is one-third of the studs (19, 19, 18). All studs, nuts and washers are examined during every 10-year ISI interval. The reactor head studs, nuts, and washers currently installed at PNPS are original equipment.

Based on the applicant's response, the project team determined that the operating experience with the applicant's Reactor Head Closure Studs Program provides evidence that the program has provided acceptable management of aging effects during the current licensed operating period and is expected to provide acceptable management of aging effects during the period of extended operation.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the Reactor Head Closure Studs Program and did not find any evidence of PNPS equipment degradation or failures that are outside the envelope of 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 concluded that the applicant's Reactor Head Closure Studs Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.14.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Reactor Head Closure Studs Program in PNPS LRA, Appendix A, Section A.2.1.27, which states that the Reactor Head Closure Studs Program includes inservice inspection (ISI) in conformance with the requirements of the ASME Code, Section XI, Subsection IWB, and preventive measures (e.g. rust inhibitors, stable lubricants, appropriate materials) to mitigate cracking and loss of material of reactor head closure studs, nuts, washers, and bushings.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.25, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.14.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.15 REACTOR VESSEL SURVEILLANCE PROGRAM (PNPS AMP B.1.26)

In PNPS LRA, Appendix B, Section B.1.26, the applicant stated that PNPS AMP B.1.26, "Reactor Vessel Surveillance Program," is an existing plant program that is consistent with GALL AMP XI.M31, "Reactor Vessel Surveillance," with an exhancement.

3.0.3.2.15.1 Program Description

The applicant stated, in the PNPS LRA, that this program manages reduction in fracture toughness of reactor vessel beltline materials to assure that the pressure boundary function of the reactor pressure vessel is maintained for the period of extended operation.

PNPS is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) as approved by License Amendment 209. This program monitors changes in the fracture toughness properties of ferritic materials in the reactor pressure vessel (RPV) beltline region. As BWRVIP-ISP capsule test reports become available for RPV materials representative of PNPS, the actual shift in the reference temperature for nil-ductility transition of the vessel material may be updated. In accordance with 10 CFR 50 Appendices G and H, PNPS reviews relevant test reports to assure compliance with fracture toughness requirements and P-T limits.

BWRVIP-116, "BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," describes the design and implementation of the ISP during the period of extended operation. BWRVIP-116 identifies additional capsules, their withdrawal schedule, and contingencies to ensure that the requirements of 10 CFR 50 Appendix H are met for the period of extended operation.

3.0.3.2.15.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.26 is consistent with GALL AMP XI.M31, 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 audit and review report for PNPS AMP B.1.26, including [the title of the program bases document goes here using the following format: Document identifier, section, "Title," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M31. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.26 and associated bases documents to determine consistency with GALL AMP XI.M31.

[Use the next sentence if more than the bases document is reviewed by the project team.] Also, the project team also reviewed [List any additional key document/information that was reviewed by the project team].

[If any differences were identified by the project team, describe them here and describe how these the issues were resolved.]

The project team reviewed those portions of the Reactor Vessel Surveillance Programfor which the applicant claims consistency with GALL AMP XI.M31 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Reactor Vessel Surveillance Program provides reasonable assurance that [project team evaluation]. The project team found the applicant's Reactor Vessel Surveillance Programacceptable because it conforms to the recommended GALL AMP XI.M31, "Reactor Vessel Surveillance," with an enhancement as described below.

3.0.3.2.15.3 Exceptions to the GALL Report

None.

3.0.3.2.15.4 Enhancements



The applicant stated, in the PNPS LRA, that the enhancements in meeting the GALL Report programelements are as follows:

Enhancement

Elements: 5: Monitoring and Trending Actions
6: Acceptance Criteria
7: Corrective Actions

Enhancement: [discussion of the enhancement]

The GALL Report identified the following recommendations for the "Monitoring and Trending Actions," "Acceptance Criteria," and "Corrective Actions" programelements associated with the enhancement:

> Reactor vessel surveillance program is plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant submits its proposed withdrawal schedule for approval prior to implementation. Thus, further staff evaluation is required for license renewal.

The applicant stated, in the PNPS LRA, that [provide discussion/basis for each enhancement(s)]. [Provide explanation as to why the enhancement to the applicant's program will provide additional assurance that the effects of aging will be adequately managed].

On this basis, the project team found this enhancement acceptable since when enhancements are implemented, PNPS AMP B.1.26, "Reactor Vessel Surveillance Program," will be consistent with GALL AMP XI.M31 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.2.15.5 Operating Experience

The applicant stated, in the PNPS LRA, that PNPS is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) as approved by Amendment 209 to the operating License. The fact that PNPS participates in the BWRVIP ISP ensures that future operating experience from all participating BWRs will be factored into this program.

[Provide project team evaluation of the operating experience.]

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Reactor Vessel Surveillance Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.



3.0.3.2.15.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Reactor Vessel Surveillance Program in PNPS LRA, Appendix A, Section A.2.1.28, which states that PNPS is a participant in the BWR vessel and internals project (BWRVIP) Integrated Surveillance Program (ISP) as incorporated into the plant Technical Specifications by License Amendment 209. The Reactor Vessel Surveillance Program monitors changes in the fracture toughness properties of ferritic materials in the reactor pressure vessel (RPV) beltline region. As BWRVIP-ISP capsule test reports become available for RPV materials representative of PNPS, the actual shift in the reference temperature for nilductility transition of the vessel material may be updated. In accordance with 10 CFR 50 Appendices G and H, PNPS reviews relevant test reports to assure compliance with fracture toughness requirements and P-T limits.

BWRVIP-116, "BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," describes the design and implementation of the ISP during the period of extended operation. BWRVIP-116 identifies additional capsules, their withdrawal schedule, and contingencies to ensure that the requirements of 10 CFR 50 Appendix H are met for the period of extended operation.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.26, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.15.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 SERVICE WATER INTEGRITY PROGRAM (PNPS AMP B.1.28)

In PNPS LRA, Appendix B, Section B.1.28, the applicant stated that PNPS AMP B.1.28, "Service Water Integrity Program," is an existing plant program that is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System," with exceptions.

3.0.3.2.16.1 Program Description

The applicant stated, in the PNPS LRA, that this program relies on implementation of the recommendations of GL 89-13 to ensure that the effects of aging on the SSW system are managed for the period of extended operation. The program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the SSW system or structures and components serviced by the SSW system.

3.0.3.2.16.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.28 is consistent with GALL AMP XI.M20, 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 audit and review report for PNPS AMP B.1.28, including Evaluation of Aging Management Programs, LRPD-02, Revision 1, Section 4.2, "Service Water Integrity Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M20. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.28 and associated bases documents to determine consistency with GALL AMP XI.M20.

The project team also reviewed PNPS Operating Experience Review Report, LRPD-05, Revision 0, Section 4.2, "Service Water Integrity Program;" "Service Water System Problems Affecting Safety Related Equipment," Generic Letter 89-13, USNRC, July 18, 1989; "Service Water System Problems Affecting Safety Related Equipment," Generic Letter 89-13, Supplement 1, USNRC, April 4, 1990. M591, Rev. E7; PNPS 1 Specification for SSW & Reactor

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Building Closed Cooling Water (RBCCW) Safety-Related Piping & Heat Exchanger Inspection, Maintenance & Test Requirements in Response to Generic Letter 89-13; NOP02E1, Rev. 01, Service Water Inspections, Maintenance and Testing in Response to Generic Letter 89-13.

The project team reviewed those portions of the Service Water Integrity Program for which the applicant claims consistency with GALL AMP XI.M20 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's Service Water Integrity Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Service Water Integrity Program acceptable because it conforms to the recommended GALL AMP XI.M20, "Service Water Integrity," with exceptions as described below.

3.0.3.2.16.3 <u>Exceptions to the GALL Report</u>

<u>Exception 1</u>

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

Element: 2: Preventive Actions
Exception: NUREG-1801 states that system components are lined or coated. Components are lined or coated only where necessary to protect the underlying metal surfaces.



The GALL Report identified the following recommendation for the "Preventive Actions" program element associated with the exception taken:

> The system components are constructed of appropriate materials and lined or coated to protect the underlying metal surfaces from being exposed to aggressive cooling water environments. Implementation of NRC GL 89-13 includes a condition and performance monitoring program; control or preventive measures, such as chemical treatment, whenever the potential for biological fouling species exists; or flushing of infrequently used systems. Treatment with chemicals mitigates microbiologically influenced corrosion (MIC) and buildup of macroscopic biological fouling species, such as blue mussels, oysters, or clams. Periodic flushing of the system removes accumulations of biofouling agents, corrosion products, and silt.

The applicant stated, in the PNPS LRA, that NUREG-1801 states that system components are constructed of appropriate materials and lined or coated to protect the underlying metal surfaces from being exposed to aggressive cooling water environments. Not all PNPS system components are lined or coated. Components are lined or coated only where necessary to protect the underlying metal surfaces.

During the audit and review, the project team asked the applicant to identify applications where components are not coated or lined and the materials of construction because not all PNPS system components are lined or coated. In response to this request, the applicant stated that the SSW supply piping is constructed of titanium, a material which has shown excellent corrosion resistance in this environment. The other components in the SSW supply are small bore piping for vents and drains, pump and valve bodies, and heat exchanger tubes. All of these components are constructed of copper alloys that have demonstrated good corrosion resistance in this environment. Also, operating experiences show that loss of material is managed by the Service Water Integrity Program such that corrective action is taken before loss of intended functions of components. On this basis, the project team found this exception acceptable.

Exception 2

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

| | |
|---|---|
| Element: | 5: Monitoring and Trending |
| Exception: | NUREG-1801 states that testing and inspections are performed annually and during refueling outages. The PNPS program requires tests and inspections during each refueling outage. |

The GALL Report identified the following recommendation for the "Monitoring and Trending" program element associated with the exception taken:

> 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 mount of MIC, if applicable. Heat transfer testing results are documented in plant test procedures and are trended and reviewed by the appropriate group.

The applicant stated, in the PNPS LRA, that the NUREG-1801 program entails testing and inspections performed annually and during refueling outages. The PNPS program requires tests and inspections during each refueling outage, but not annually. Since aging effects are typically manifested over several years, the difference in inspection and testing frequency is insignificant.

During the audit and review, the project team evaluated the PNPS inspection interval and agreed that adverse conditions caused by the aging effects in the service water systems manifest over several years. Also, operating experience demonstrates that a 2-year interval has not led to adverse operating conditions of the Service Water System. Therefore, the difference between a 1-year and 2-year inspection and testing frequency is insignificant. On this basis, the project team found this exception acceptable.

3.0.3.2.16.4 Enhancements

None.

3.0.3.2.16.5 Operating Experience

The applicant stated, in the PNPS LRA, that results of heat transfer capability testing of the RBCCW heat exchangers from 2001 through 2004 show that the heat exchangers are capable of removing the required amount of heat. Confirmation of adequate thermal performance provides evidence that the program is effective for managing fouling of SSW cooled heat exchangers.

Results of SSW visual inspections, eddy current testing, ultrasonic testing, and radiography testing from 1998 through 2004 revealed areas of erosion and areas of corrosion on internal and external surfaces. SSW butterfly valves, pump discharge check valves, air removal valves, and pipe spools have been replaced with components made of corrosion resistant materials. Also, RBCCW heat exchanger channel assemblies have been replaced and tubes have been sleeved to address erosion and corrosion. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing loss of material for SSW system components.

Visual inspections of SSW piping revealed degradation of the lining in original SSW carbon steel rubber lined piping. Pipe lining is intended to protect pipe internal surfaces from erosion and corrosion. Therefore, SSW piping has been replaced with carbon steel pipe with cured-in-place rubber lining, relined with a ceramic epoxy compound, or replaced with titanium pipe. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing loss of material for SSW system components.



The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the Service Water Integrity Program and did not find any evidence of PNPS component degradation or failures that are outside the envelope of 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 concluded that the applicant's Service Water Integrity Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.16.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Service Water Integrity Program in PNPS LRA, Appendix A, Section A.2.1.30, which states that the Service Water Integrity Program relies on implementation of the recommendations of NRC GL 89-13 to ensure that the effects of aging on the SSW system are managed for the period of extended operation. The program includes component inspections for erosion, corrosion, and blockage and performance monitoring to verify the heat transfer capability of the safety-related heat exchangers cooled by SSW. Chemical treatment using biocides and chlorine and periodic cleaning and flushing of redundant or infrequently used loops are the methods used to control or prevent fouling within the heat exchangers and loss of material in SSW components.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.28, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.16.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).



3.0.3.2.17 STRUCTURES MONITORING - STRUCTURES MONITORING PROGRAM (PNPS AMP B.1.29.2)

In PNPS LRA, Appendix B, Section B.1.29.2, the applicant stated that PNPS AMP B.1.29.2, "Structures Monitoring – Structures Monitoring Program," is an existing plant program that is consistent with GALL AMP XI.S6, "Structures Monitoring Program," with enhancements.

3.0.3.2.17.1 Program Description

The applicant stated, in the PNPS LRA, that structures monitoring in accordance with 10 CFR 50.65 (Maintenance Rule) is addressed in Regulatory Guide 1.160 and NUMARC 93-01. These two documents provide guidance for development of licensee-specific programs to monitor the condition of structures and structural components within the scope of the Maintenance Rule, such that there is no loss of structure or structural component intended function. Since protective coatings are not relied upon to manage the effects of aging for structures included in the Structures Monitoring Program, the program does not address protective coating monitoring and maintenance.

3.0.3.2.17.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.29.2 is 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 audit and review report for PNPS AMP B.1.29.2, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.21, "Structures Monitoring Programs," which provides an assessment of the AMP elements' consistency with GALL AMP XI.S6. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.29.2 and associated bases documents to determine consistency with GALL AMP XI.S6.

The project team also reviewed PNPS procedure: "Building & Structures System 56," MRSSC58, Revision 1; "Structure Inspection and Condition Monitoring," NE8.02, Revision 3.

The project team reviewed those portions of the Structures Monitoring Program for which the applicant claims consistency with GALL AMP XI.S6 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Structures Monitoring Program provides reasonable assurance that the Structures Monitoring Program will be adequately managed for the period of extended operation. The project team found the applicant's Structures Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.S6, "Structures Monitoring Program," with enhancements as described below.

3.0.3.2.17.3 Exceptions to the GALL Report

None.

3.0.3.2.17.4 Enhancements



The applicant stated, in the PNPS LRA, that the enhancements in meeting the GALL Report program elements are as follows:

Enhancement 1

Element: 1: Scope of Program
Enhancement: The Structures Monitoring program procedure will be enhanced to clarify that the discharge structure, security diesel generator building, trenches, valve pits, manholes, duct banks, underground fuel oil tank foundations, manway seals and gaskets, hatch seals and gaskets, underwater concrete in the intake structure, and crane rails and girders are included in the program.

The GALL Report identified the following recommendation for the "Scope of Program" program element associated with the enhancement:

> The applicant specifies the structure/aging effect combinations that are managed by its Structures Monitoring Program.

The applicant stated, in the PNPS LRA, that the Structures Monitoring Program at PNPS is comparable to the program described in NUREG-1801, Section XI.S6, "Structures Monitoring Program." The Structures Monitoring Program will be enhanced to clarify that the discharge structure, security diesel generator building, trenches, valve pits, manholes, duct banks, underground fuel oil tank foundations, manway seals and gaskets, hatch seal and gaskets, underwater concrete in the intake structure, crane rails and girders are included in the program. The structures, structural components, and their aging effects requiring management under scope of Structures Monitoring Program are included in LRA Tables 3.5.2-1 through 3.5.2-6. Visual inspections of accessible plant structures are performed at 3-year intervals and inspections of normally inaccessible (insulated or high radiation zone) areas are performed at 10-year intervals. Visual inspections of buried plant structures are performed when opportunistic excavation occurs. However, more frequent inspections may be performed based on past inspection results, industry experience, or exposure to a significant event (e.g. tornado, earthquake, fire, and chemical spill).

On this basis, the project team found this enhancement acceptable because when enhancements are implemented, PNPS AMP B.1.29.2, "Structures Monitoring – Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and will provide additional assurance that the effects of aging will be adequately managed.

<u>Enhancement 2</u>

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Enhancement: | Guidance for performing structural examinations of elastomers (seals, gaskets, seismic joint filler, and roof elastomers) to identify cracking and change in material properties will be added to the structures Monitoring Program procedure. The GALL Report identified the following recommendation for the "Discussion of Aging Effects" 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 structure monitoring program is to contain sufficient detail on detection to conclude that this program attribute is satisfied.

The applicant stated, in the PNPS LRA, that cracks, gaps and corrosion will be monitored as stated in LRPD-02 and Attachment 4 Structures Monitoring Program General Criteria. For concrete, structures monitoring manage loss of material, cracking, and change in material properties, as identified in LRA Tables 3.5.2-1 through 3.5.2-6. The acceptance criteria are the absence of the following: cracks, excessive rust bleeding, staining or discoloration, abrasion, erosion, cavitation, spalling, scaling, leaching, excessive settlement, corrosion of reinforcing, degraded waterproof membranes. For steel, the Structures Monitoring Program manages the loss of material, as identified in LRA Tables 3.5.2-1 through 3.5.2-6. The acceptance criteria are the absence of the following: pitting, beam/column deflection, cracks, flaking coatings, excessive rust, loose/missing bolts, peeling paint, wide spread corrosion. For elastomers, the aging effect managed are cracking and change in material properties. The acceptance criteria will include the absence of cracks and gaps.

On this basis, the project team found this enhancement acceptable because when enhancements are implemented, PNPS AMP B.1.29.2, "Structures Monitoring – Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.2.17.5 Operating Experience

The applicant stated, in the PNPS LRA, that inspections of structural steel, concrete exposed to fluid, and structural elastomers from 1998 through 2004 revealed signs of degradation such as cracks, gaps, corrosion (rust), and flaking coatings. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for structural components.

Structural inspection of pipe supports and cable trays in November 2004 revealed numerous minor signs of degradation which were repaired. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for structural components.

A self-assessment in July 2005 revealed no issues or findings that could impact effectiveness of the program.

The applicant also stated, in the industry operating experience at Dresden/Quad Cities (BWR units have a history of problems with containment penetration bellows): "There are no PNPS site-specific operating experiences similar to that of Dresden/Quad Cities. The normal environment for the PNPS drywell is dry, and there has been no indication of contamination of the bellows during construction at PNPS. In addition, containment bellows for PNPS are not exposed to a corrosive environment. As such SCC is not applicable to PNPS stainless steel bellows."

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Structures Monitoring Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.17.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Structures Monitoring Program in PNPS LRA, Appendix A, Section A.2.1.32, which states that the Structures Monitoring Program is in accordance with 10 CFR 50.65 (Maintenance Rule) as addressed in Regulatory Guide 1.160 and NUMARC 93-01. Periodic inspections are used to monitor the condition of structures and structural components to ensure there is no loss of structure or structural component intended function.

Element 1: Scope of Program, Letter 2.06.003, Commitment No. 25: Enhance the Structures Monitoring Program procedure to clarify that the discharge structure, security diesel generator building, trench, valve pits, manholes, duck banks, underground fuel oil tank foundations, manway seals and gaskets, hatch seals and gaskets, underwater concrete in the intake structure, and crane rails and girders are included in the program. In addition, the Structures Monitoring Program will be revised to require opportunistic inspections of inaccessible concrete areas when they become accessible.

Element 4: Detection of Aging Effects, Letter 02.03.003, Commitment No. 26: Enhance Structures Monitoring Program guidance for performing structural examinations of elastomers (seals, gaskets, seismic joint filler, and roof elastomers) to identify cracking and change in material properties will also be added to the Structures Monitoring Program procedure.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.29.2, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.17.7 <u>Conclusion</u>

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 <u>STRUCTURES MONITORING – WATER CONTROL STRUCTURES MONITORING PROGRAM (PNPS AMP B.1.29.3)</u>

In PNPS LRA, Appendix B, Section B.1.29.3, the applicant stated that PNPS AMP B.1.29.3, "Structures Monitoring – Water Control Structures Monitoring Program," is an existing plant program that is consistent with GALL AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," with an enhancement.

3.0.3.2.18.1 <u>Program Description</u>

The applicant stated, in the PNPS LRA, that the program includes visual inspections to manage loss of material and loss of form for water-control structures (breakwaters, jetties, and revetments). The water-control structures are of rubble mound construction with the outer layer protected by heavy capstone. Parameters monitored include settlement (vertical displacement) and rock displacement. These parameters are consistent with those described in RG 1.127.

3.0.3.2.18.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.29.3 is consistent with GALL AMP XI.S7, 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 audit and review report for PNPS AMP B.1.29.3, including Aging Management Program Evaluation Report LRPD-02, Revision 1, Section 4.21.3, "Water Control Structures Monitoring Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.S7. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.29.3 and associated bases documents to determine consistency with GALL AMP XI.S7.

The project team also reviewed PNPS procedure: 3.M.5-3 "Main Breakwater Monitoring and Repair Procedure," Revision 0.

The project team reviewed those portions of the Water Control Structures Monitoring Program for which the applicant claims consistency with GALL AMP XI.S7 and found that the PNPS program is comparable to the program described in NUREG-1801, Section XI.S7, RG 1.127, "Inspection of Water Control Structures Associated with Nuclear Power Plants." The program includes visual inspections to manage loss of material and loss of form for water control structures (breakwaters, jetties, and revetments). The water control structures are of rubble mound construction with the outer layer protected by heavy capstone. Parameters monitored include settlement (vertical displacement) and rock displacement. These parameters are consistent with those described in RG 1.127. There are no underwater supports identified in scope of this program. Visual inspections are performed on water control structures at least every five years and following major storms (Ref. Aging Management Program Evaluation Report LRPD-02, Section 4.21.3.4[b]). For that, they are consistent with the GALL Report AMP. Furthermore, the project team concluded that the applicant's Water Control Structures Monitoring Program provides reasonable assurance that the Water Control Structures Monitoring Program will be adequately managed for the period of extended operation. The project team found the applicant's Water Control Structures Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.S7, RG 1.127, "Inspection of Water Control Structures Associated with Nuclear Power Plants," with the enhancement as described below.

3.0.3.2.18.3 Exceptions to the GALL Report

None.

3.0.3.2.18.4 Enhancements

The applicant stated, in the PNPS LRA, that the enhancements in meeting the GALL Report program elements are as follows:

Enhancement

Element: 1: Scope of Program
Enhancement: Program scope will be enhanced to include the east breakwater, jetties, and onshore revetments in addition to the main breakwater.

The GALL Report identified the following recommendation for the "Scope of Program" program element associated with the enhancement:

> RG 1.127 applies to water-control structures associated with emergency cooling water systems or flood protection of nuclear power plants. The water-control structures included in the RG 1.127 program are concrete structures; embankment structures; spillway structures and outlet works; reservoirs; cooling water channels and canals, and intake and discharge structures; and safety and performance instrumentation.

The applicant stated, in the PNPS LRA, that the Water Control Structures Monitoring Program at PNPS is comparable to the program described in NUREG-1801, Section XI.S7, RG 1.127, "Inspection of Water Control Structures Associated with Nuclear Power Plants." The program includes visual inspections to manage loss of material and loss of form for water control structures (breakwaters, jetties, and revetments). The water control structures are of rubble mound construction with the outer layer protected by heavy capstone. The parameters monitored include settlement and are consistent with that described in RG 1.127. There are no underwater supports identified in the scope of this program. However, the program scope will be enhanced to include the east breakwater, jetties, and onshore revetments in addition to the main breakwater (commitment number 27).

On this basis, the project team found this enhancement acceptable because when enhancements are implemented, PNPS AMP B.1.29.3, "Structures Monitoring – Water Control Structures Monitoring Program," will be consistent with GALL AMP XI.S7 and will provide additional assurance that the effects of aging will be adequately managed.

3.0.3.2.18.5 Operating Experience

The applicant stated, in the PNPS LRA, that preliminary results of the 2004 inspection of the main breakwater indicated one area of the breakwater had rock displacement resulting in the complete dislodging of the rocks on the shore side of the main breakwater. Since the discontinuity extended beyond the facade but did not involve the full height or width of the water-control structure, an evaluation was performed to determine if repair was required to restore the designed stability of the structure. Results of the evaluation show that the designed stability of the structure was not impacted; however, a work request was issued to repair the structure due to the possibility of future storms extending the damaged areas and restriction to personnel from easily walking on the structure. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing loss of material and loss of form for water-control structures.

The project team reviewed the CR-PNP-2004-03938 (12/13/2004) dislodged at point "L" station "5," shore side; CR-PNP-2005-00098 (01/10/2005) dislodged at point "L" station "5," channel side (adjacent to CR-PNP-2004-03933 but, smaller size, CR-PNP-2005-00450 (01/23/2005) at multiple areas in the smaller size in comparing to the previous two; and CR-PNP-2005-03018. PNPS Maintenance Request (MR) # 04118760 to repair on CR-PNP-2004-03893, 2005-00093, 2005-00450, and 2005-03018 had been completed and closed.

The Water Control Structures Monitoring Program has been effective at managing aging effects. The Water Control Structures Monitoring Program provides reasonable assurance that the effects of aging will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation

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

The project team recognized that the corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

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 concluded that the applicant's Water Control Structures Monitoring Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.18.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Water Control Structures Monitoring Program in PNPS LRA, Appendix A, Section A.2.1.33, which states that the Water Control Structures Monitoring Program includes visual inspections to manage loss of material and loss of form for water-control structures (breakwaters, jetties, and revetments). The water-control structures are of rubble mound construction with the outer layer protected by heavy capstone. Parameters monitored include settlement (vertical displacement) and rock displacement. These parameters are consistent with those described in RG 1.127.

Element 1: Scope of Program, Letter 2.06.003, Commitment No. 27: Program scope will be enhanced to include the east breakwater, jetties, and onshore revetments in addition to the main breakwater.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.2.3, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.18.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements, for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. The project team found 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). 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team also reviewed the UFSAR Supplement for this AMP and found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

### 3.0.3.2.19 WATER CHEMISTRY CONTROL – CLOSED COOLING WATER PROGRAM (PNPS AMP B.1.32.3)

In PNPS LRA, Appendix B, Section B.1.32.3, the applicant stated that PNPS AMP B.1.32.3, "Water Chemistry Control – Closed Cooling Water Program," is an existing plant program that is consistent with GALL AMP XI.M21, "Closed-Cycle Cooling Water System," with an exception.

#### 3.0.3.2.19.1 Program Description

The applicant stated, in the PNPS LRA, that this program includes preventive measures that manage loss of material, cracking, and fouling for components in closed cooling water systems (reactor building closed cooling water, turbine building closed cooling water, emergency diesel generator cooling water, station blackout diesel cooling water, security diesel generator cooling water, and plant heating). These chemistry activities provide for monitoring and controlling closed cooling water chemistry using PNPS procedures and processes based on EPRI guidance for closed cooling water chemistry.

#### 3.0.3.2.19.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.32.3 is consistent with GALL AMP XI.M21, 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 audit and review report for PNPS AMP B.1.32.3, including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.23.3, "Water Chemistry Control Closed Cooling Water Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M21. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.32.3 and associated bases documents to determine consistency with GALL AMP XI.M21.

The project team also reviewed PNPS License Renewal Project Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.29, "Water Chemistry Control - Closed Cooling Water Program;" PNPS Procedure No. 7.8.1, Rev. 40, Chemistry Sample and Analysis Program Procedure; and PNPS Procedure No. 7.8.7, Rev. 1, Recording and Trending of Chemistry Data Procedure.

In the programdescription, the GALL Report recommends testing and inspection to monitor the effects of corrosion and SCC on the intended function of the component. The applicant does not include performance testing as part of this program. The applicant stated that EPRI report TR-107396does not recommend that equipment performance and functional testing be part of a water chemistry control program. Rather, EPRI reportTR-107396 states in Section 5.7 (Section 8.4 in EPRI report 1007820) that performance monitoring is typically part of an engineering program, which would not be part of waterchemistry. Usually this performanceand functional testing is part of the Maintenance Rule for active components. Thus, the testing as recommended is performed except it is not part of the Water Chemistry Programand is therefore found acceptable.

The project team noted that the exception taken for element 4, Detection of Aging Effects, concerning the performance and functional testing should also have been applied to element 3, Parameters Monitored/Inspected, for the same reason that it applies to element 4. The project team asked the applicant to justify why this exception also does not apply to element 3. In its response, the applicant stated that the exception in LRA Section B.1.32.3, which was applied to the detection of aging effects attribute (element 4), is equally applicable to the parameters monitored/trended attribute (element 3). The exception was discussed under Element 4 since it is more directly related to detection of aging effects. However, LRA Section B.1.32.3 will be amended to indicate that the exception is applicable to both attribute 3, Parameters Monitored/Trended and attribute 4, Detection of Aging Effects. This requires an amendment to the LRA. **(Open Item)** The exception is addressed in Section 3.0.3.2.19.3 of this audit and review report.

The GALL Report recommends that for "susceptible locations," a one-time inspection verification program may be appropriate. The project team asked the applicant if it intended to implement a One-Time Inspection Program for this Water Chemistry Control Program. If so, the applicant was asked why this is not included in the UFSAR Supplement Appendix A for this program. In its response, the applicant stated yes, the One-Time Inspection Program described in LRA Section B.1.23 includes inspections to verify the effectiveness of the water chemistry control aging management programs by confirming that unacceptable cracking, loss of material, and fouling is not occurring. Discussions in LRA Section 3, Table 1 provide the link between the One-Time Inspection Program and Water Chemistry Control Program for susceptible components. However, for clarity, LRA Appendix A descriptions for the Water Chemistry Control - Closed Cooling Water Program will be amended to provide a link to the One-Time Inspection Program activities to confirm the effectiveness of these programs. **This requires an amendment to the LRA. (Open Item)**. Based on changes to the Appendix A write-up, the applicant response was found acceptable.

The project team reviewed those portions of the Water Chemistry Control – Closed Cooling Water Programfor which the applicant claims consistency with GALL AMP XI.M21 and found that they are consistent with the GALL Report AMP. Furthermore,the project team concludes that the applicant's Water Chemistry Control – Closed Cooling Water Program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The project team found the applicant's Water Chemistry

Control – Closed Cooling Water Program acceptable because it conforms to the recommended GALL AMP XI.M21, "Closed-Cycle Cooling Water System," with the exception as described below.

3.0.3.2.19.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

Exception

Element: 4: Detection of Aging Effects

Exception: The PNPS Water Chemistry Control – Closed Cooling Water Program does not include performance and functional testing.

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

> Control of water chemistry does not preclude corrosion or SCC at locations of stagnant flow conditions or crevices. Degradation of a component due to corrosion or SCC would result in degradation of system or component performance. The extent and schedule of inspections and testing should assure detection of corrosion or SCC before the loss of the intended function of the component. Performance and functional testing ensures acceptable functioning of the CCCW system or components serviced by the CCCW system. For systems and components in continuous operation, performance adequacy should be verified by monitoring component performance through data trends for evaluation of heat transfer capability, system branch flow changes, and chemistry data trends. Components not normally in operation are periodically tested to ensure operability.

The applicant stated, in the PNPS LRA, that while NUREG-1801, Section XI.M21, "Closed-Cycle Cooling Water System" endorses EPRI report TR-107396 for performance and functional testing guidance, EPRI report TR-107396 does not recommend that equipment performance and functional testing be part of a water chemistry control program. This appears appropriate since monitoring pump performance parameters are of little value in managing effects of aging on long-lived, passive CCW system components. Rather, EPRI report TR-107396 states in Section 5.7 (Section 8.4 in EPRI report 1007820) that performance monitoring is typically part of an engineering program, which would not be part of water chemistry. In most cases, functional and performance testing verifies that component active functions can be accomplished and as such would be included as part of Maintenance Rule (10 CFR 50.65). Passive intended functions of pumps, heat exchangers, and other components will be adequately managed by the closed cooling water chemistry program through monitoring and control of water chemistry parameters.

The project team reviewed EPRI Report TR-107396 and agreed with the applicant that it does not recommend that performance and functional be a part of the water chemistry control program. This testing could be performed as part of another program. Usually, the Maintenance

Rule dictates the requirements of the performance and functional testing. However, in the last sentence of the applicant justification, PNPS stated that the passive intended functions were adequately managed by the closed cooling water chemistry control program through monitoring and control of water chemistry. The project team asked the applicant whether the One-Time Inspection Program was also used to verify the effectiveness of the chemistry program and, if so, should it be addressed as part of the exception justification. In its response, the applicant stated that for clarity, LRA Section B.1.23.3, exception note 1 will be revised to state: "Passive intended functions of pumps, heat exchangers, and other components will be adequately managed by the Closed Cooling Water Chemistry and One-Time Inspection Programs through monitoring and control of water chemistry parameters and verification of the absence of aging effects." **(Open Item)** On this basis, the project team found the applicant response acceptable and found the exception acceptable.

3.0.3.2.19.4 Enhancements

None.

3.0.3.2.19.5 Operating Experience

The applicant stated, in the PNPS LRA, that during the period from 1998 through 2004, several condition reports were initiated due to adverse trends in parameters (nitrite and tolytriazole) monitored by the Water Chemistry Control – Closed Cooling Water Program. Corrective actions were taken within the Corrective Action Program to preclude reaching unacceptable values. No increases, long or short term, were observed in iron or copper levels. Continuous confirmation of water quality and corrective action prior to reaching control limits provide evidence that the program is effective in managing aging effects for applicable components.

During the period from 1998 through 2004, two condition reports were initiated due to parameters monitored by the Water Chemistry Control – Closed Cooling Water Program outside of administrative limits, but still within EPRI acceptance criteria. Corrective actions were taken within the Corrective Action Program to preclude violating EPRI acceptance criteria. Continuous confirmation of water quality and corrective action prior to reaching control limits provide evidence that the program is effective in managing aging effects for applicable components.

During the period from 1998 through 2004, a few incidents were found in which station heating system parameters monitored by the Water Chemistry Control – Closed Cooling Water Program were outside of EPRI action level 1 acceptance criteria. Monitoring frequency was increased and the parameter was returned to within the prescribed normal operating range as soon as possible (well within the 90 days permitted by action level 1). Continuous confirmation of water quality and timely corrective action provide evidence that the program is effective in managing aging effects for applicable components.

QA audits in 2000 and 2002 revealed no issues or findings that could impact effectiveness of the program.

A self-assessment in October 2003 noted that chemistry specifications and methods of control are not clearly established for nonsafety-related diesel jacket coolant systems. This assessment and a QA audit in early 2004 revealed that corrective actions for condition reports addressing closed cooling water (CCW) analyses had not been completed in a timely manner. Specifically, condition reports initiated in early 2003 identified that for RBCCW, TBCCW, and plant heating, some chemical analyses are not being performed in the frequencies defined in procedures due to faulty analysis equipment. In June 2004, corrective actions had not been completed. Corrective actions were taken by the end of 2004 to reinstate all analyses and confirm water quality for the RBCCW, TBCCW, and plant heating systems. Completion of corrective actions and confirmation of water quality provide evidence that the program is effective in managing aging effects for applicable components.

When the revised EPRI CCW Guidelines were first implemented (January 2005), new jacket coolant chemistry parameters did not meet recommendations for the EDG, SBO, and security diesels. The parameters that did not meet recommendations are indicators that the glycol and corrosion inhibitor products in the jacket cooling water systems are degrading and becoming less effective. Evaluation determined that there were no immediate concerns of corrosion or cooling ability breakdown for the diesels as other parameter routinely analyzed are in specification and had no adverse trend to indicate an immediate need for action. Work requests were issued to change the SBO and security diesel cooling water during the next maintenance window. Evaluation determined that EDG jacket coolant change-out was not warranted. Continuous confirmation of water quality and timely corrective action provide evidence that the program is effective in managing aging effects for applicable components.

A self-assessment of the Water Chemistry Control – Closed Cooling Water Program was performed in August 2005 to assess how well the program is implementing the revised EPRI CCW guidelines. The assessment concluded that open issues remain regarding the tolytriazole achievable limit for the security diesel and reserve alkalinity achievable limit for the EDGs and SBO diesel. Resolution of these open issues is scheduled to assure that the program is effective in managing aging effects for applicable components.

The project team reviewed the operating experience provided in the PNPS 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. The project team reviewed Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.29, "Water Chemistry Control - Closed Cooling Water Program." Several instances where the limit levels were exceeded are identified, with appropriate actions taken. The program is effective in managing aging effects.

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 concluded that the applicant's Water Chemistry Control – Closed Cooling Water Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.19.6 <u>UFSAR Supplement</u>

The applicant provided its UFSAR Supplement for the Water Chemistry Control – Closed Cooling Water Program in PNPS LRA, Appendix A, Section A.2.1.38, which states that the Water Chemistry Control – Closed Cooling Water Program includes preventive measures that manage loss of material, cracking, and fouling for components in closed cooling water systems (reactor building closed cooling water, turbine building closed cooling water, emergency diesel generator cooling water, station blackout diesel cooling water, security diesel generator cooling water, and plant heating). These chemistry activities provide for monitoring and controlling closed cooling water chemistry using PNPS procedures and processes based on EPRI guidance for closed cooling water chemistry.

As stated above in Section 3.0.3.2.19.2, the UFSAR Supplement will be amended to provide a link to the One-Time Inspection Program activities to confirm the effectiveness of this water chemistry control program. **(Open Item)**

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.32.3, 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 FSAR Supplement table and as required by 10 CFR 54.21(d).

3.0.3.2.19.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. 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 found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

### 3.0.3.3 PNPS AMPs That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

3.0.3.3.1 HEAT EXCHANGER MONITORING PROGRAM (PNPS AMP B.1.15)

In the PNPS LRA, Appendix B, Section B.1.15, the applicant described PNPS AMP B.1.15, "Heat Exchanger Monitoring Program."

The applicant stated that PNPS AMP B.1.15 is a new plant-specific program. The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation. If degradation is found, then an evaluation will be performed to evaluate its effects on the heat exchanger's design functions including its ability to withstand a seismic event.

Representative tubes within the sample population of heat exchangers will be eddy current tested at a frequency determined by internal and external operating experience to ensure that effects of aging are identified prior to loss of intended function. Along with each eddy current test, visual inspections will be performedon accessible heat exchanger heads, covers and tube sheets to monitor surface condition for indications of loss of material. The sample population of heat exchangers includes the RHR heat exchangers, core spray pump motor thrust bearing lube oil coolers, HPCI gland seal condenser, HPCI turbine lube oil cooler, RCIC lube oil cooler, recirculation pump motor generator set fluid coupling oil and bearing coolers, CRD pump oil coolers, recirculation pump motor lube oil coolers, clean up recirculation pump lube oil coolers and stuffing box cooler, and EDG lube oil coolers.

The program will be initiated prior to the period of extended operation.

The project team reviewed, in whole or part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.15 including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.9, "Heat Exchanger Monitoring Program," and interviewed the applicant's technical staff.

3.0.3.3.1.1 <u>Review of the PNPS AMP B.1.15 Against the Program Elements</u>

The project team reviewed PNPS AMP B.1.15 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 review process as described in the PNPS audit and review plan.



3.0.3.3.1.1.1 <u>Scope of Program</u>

The "Scope of Program" program element 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.

The applicant stated in PNPS AMP B.1.15, for the "Scope of Program" program element, that this program will manage aging effects on selected heat exchangers in various systems as identified in aging management reviews.

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

3.0.3.3.1.1.2 <u>Preventive Actions</u>

The "Preventive Actions" program element in Appendix A.1.2.3.2 of the SRP-LR are that (1) the activities for prevention and mitigation programs should be described, and (2) for condition or performance monitoring programs that do not rely on preventive actions, and thus, preventive actions need not be provided.

The applicant stated in PNPS AMP B.1.15, for the "Preventive Actions" program element, that this program is an inspection program and no actions are taken as part of this program to prevent degradation.

The project team determined that the "Preventive Actions" program element satisfies the criteria defined in Appendix A.1.2.3.2 of the SRP-LR. This is an inspection program and no actions are taken as part of this program to prevent degradation. Item 2 of the SRP Preventative Action is not applicable because the Heat Exchanger Monitoring Program is an inspection program. Preventative actions of this program are consistent with SRP-LR. On this basis, the project team found that the applicant's "Preventive Actions" acceptable.

3.0.3.3.1.1.3 Parameters Monitored/Inspected

The "Parameters Monitored/Inspected" program element in Appendix A.1.2.3.3 of the SRP-LR can be summarized as:

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



The applicant stated in PNPS AMP B.1.15, for the "Parameters Monitored/Inspected" program element, that where practical, eddy current inspections of shell-and-tube heat exchanger tubes will be performed to determine tube wall thickness. Visual inspections will be performed on heat exchanger heads, covers and tube sheets where accessible to monitor surface condition for indications of loss of material.

The project team determined this program element satisfies the criteria defined in Appendix A.1.2.3.3 of the SRP-LR. Heat exchanger tubes will be subjected to eddy current inspection to determine wall thickness. Visual inspections will be performed on heat exchanger heads, covers, and tube sheets for loss of material. Inspection techniques linked to specific degradation are identified. Parameters monitored/inspected in this program are consistent with the SRP-LR On this basis, the project team found that the applicant's description of the "Parameters Monitored/Inspected" is acceptable.

3.0.3.3.1.1.4 Detection of Aging Effects

The "Detection of Aging Effects" program element in Appendix A.1.2.3.4 of the SRP-LR can be summarized as:

> Provide information that links the parameters to be monitored or inspected to the aging effects being managed.

> Describe when, where, and how program data are collected (i.e., all aspects of activities to collect data as part of the program).
>
> Link the method or technique and frequency, if applicable, to plant-specific or industry-wide operating experience.
>
> Provide the basis for the inspection population and sample size when sampling is used to inspect a group of SCs. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.

The applicant stated in PNPS AMP B.1.15 for the "Detection of Aging Effects" program element that loss of material is the aging effect managed by this program. Representative tubes within the sample population of heat exchangers will be eddy current tested at a frequency determined by internal and external operating experience to ensure that effects of aging are identified prior to loss of intended function. Visual inspections of accessible heat exchangers will be performed on the same frequency as eddy current inspections.

An appropriate sample population of heat exchangers will be determined based on operating experience prior to inspections. Inspection can reveal loss of material that could result in degradation of the heat exchangers. Fouling is not addressed by this program.

The project team determined that this program element satisfies the criteria defined in Appendix A.1.2.3.4 of the SRP-LR. Representative tubes within a sample population of heat exchangers will be eddy current tested at a frequency determined by operating experience. Visual inspections of accessible heat exchangers will be performed at the same frequency as the eddy current inspections. Sample population will be based on operating experience prior to the inspections. Parameters to be inspected (wall thickness and evidence of corrosion) are appropriate to assure the heat exchangers will be adequately maintained for license renewal under all CLB design conditions. However, the project team noticed that there were no provisions to detect localize corrosion such as MIC and crevice corrosion. As a result the applicant was requested to identify what method(s) will be used to detect localized corrosion and areas to be inspected and frequency of inspections for localized corrosion.

In its response, the applicant stated that this is a new program and the details have not yet been developed. In accordance with LRPD-02 Sections 3.2.B.3 and 3.2.B.4, where practical, eddy current inspections of shell-and-tube heat exchanger tubes will be performed to determine tube wall thickness. Visual inspections will be performed on heat exchanger heads, covers and tube sheets where accessible to monitor surface condition for indications of loss of material such as areas where localized corrosion could occur (i.e. stagnant/low flow areas). A potential approach for determining the inspection frequency would be that once the initial inspections are completed, the results would be used to determine the frequency to ensure that effects of aging are identified prior to loss of intended function. Inspection frequency will be dependent on the specific component operating parameters (process fluid, cooling medium, pressures, materials), maintenance history, licensing commitments, NEIL Loss Control Standards and OE. The project team determined that the applicant's response to this request was acceptable because this approach to establishing inspection locations for localized corrosion will provide additional assurance that the effects of aging will adequately managed.

During the audit and review process, the project team determined that more detail was needed to evaluate the adequacy sample size and frequency. The project team asked the applicant to provide additional details describing the methods that will be used establish sample size and frequency. In its response, the applicant stated that a review of the specific component's mechanical design, environments, operating conditions, and flow paths combined with its maintenance history, and internal and external OE will be used to determine the sample size and frequency. The sample size will most likely include peripheral tubes and areas within a particular heat exchanger that are more susceptible to wear, corrosion, or damage (i.e., adjacent to inlet/outlet nozzles and changes in flow direction) and will consider industry best practices and EPRI recommendations. Once the initial inspections are completed, the results will be used to determine the frequency to ensure that effects of aging are identified prior to loss of intended function. Visual inspections of accessible heat exchangers will be performed on the same frequency as eddy current inspections. The project team determined that the applicant's response to this request was acceptable because this approach to establishing inspection sample size and frequency will provide additional assurance that the effects of aging will adequately managed.

The project team also noticed that the Heat Exchanger Monitoring Program does not describe when, where, and how program data are collected. Therefore the project team requested the applicant to provide detail on data collection. In its response, the applicant stated that this is a new program and the details of data collection are not available. However, inspections will be performed either online or during refueling outages (dependent on the particular component). The data will be collected and analyzed, and required actions will be taken at that time. The data will also be utilized for longer term trending and developing future action plans and will be maintained in accordance with site QA program requirements. The project team determined that the applicant's response to this request was acceptable because this approach to establishing data collection will provide additional assurance that the effects of aging will adequately managed.

On this basis, the project team found that the applicant's description of the "Detection of Aging Effects" is acceptable.

3.0.3.3.1.1.5 Monitoring and Trending

The "Monitoring and Trending" program element in Appendix A.1.2.3.5 of the SRP-LR can be summarized as:

> 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 are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The applicant stated in PNPS AMP B.1.15, for the "Monitoring and Trending" program element, that results will be evaluated against established acceptance criteria and an assessment will be made regarding the applicable degradation mechanism, degradation rate and allowable degradation level. This information will be used to develop future inspection scope and to modify inspection frequency, if appropriate. Wall thickness will be trended and projected to the next inspection. Corrective actions will be taken if projections indicate that the acceptance criteria may not be met at the next inspection.

The project team determined that for visual inspection, this program element satisfies the criteria defined in Appendix A.1.2.3.5 of the SRP-LR. The PNPS Heat Exchanger Monitoring Program states the inspection results will be evaluated against established criteria. During the audit and review process, the project team determined that monitoring and trending is not described in enough detail such that an assessment of the predictability of extent of degradation could not be made. As a result, the applicant was requested to provide details describing the methods to assess remaining component life for loss of material using inspection results such that timely mitigative action can be made.

In its response, the applicant stated that because this is a new program exact details are not yet available. Wall thickness will be trended and projected to the next inspection. Corrective actions will be taken if projections indicate that the acceptance criteria may not be met at the next inspection. Reference LRPD-02 section 3.2.B.6. Trend information along with OE will be utilized to determine the remaining component life. The project team determined that the applicant's response to this request was acceptable because this approach to establishing remaining component life will provide additional assurance that the effects of aging will adequately managed.

On this basis, the project team found that the applicant's description of the "Monitoring and Trending" is acceptable.

3.0.3.3.1.1.6 <u>Acceptance Criteria</u>

The "Acceptance Criteria" program element in Appendix A.1.2.3.6 of the SRP-LR can be summarized as:

> The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.
>
> The program should include a methodology for analyzing the results against applicable acceptance criteria.
>
> Qualitative 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 stated in PNPS AMP B.1.15, for the "Acceptance Criteria" program element, that the minimum acceptable tube wall thickness for each heat exchanger to be eddy current inspected will be established based upon a component-specific engineering evaluation. Wall thickness will be acceptable if greater than the minimum wall thickness for the component.

The acceptance criterion for visual inspections of heat exchanger heads, covers, and tubesheets will be no evidence of degradation that could lead to loss of function. If degradation that could lead to loss of intended function is detected, a condition report will be written and the issue resolved in accordance with the site corrective action program. The acceptance criterion for visual inspections of heat exchanger heads, covers, and tubesheets will be no evidence of degradation that could lead to loss of function. If degradation that could lead to loss of intended function is detected, a condition report will be written and the issue resolved in accordance with the site corrective action program.

The project team determined this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.6 of the SRP-LR. The PNPS Heat Exchanger Monitoring Program states that minimum wall thickness will be established based on a component-specific engineering evaluation. However, no numerical values or process to establish acceptance criteria were provided. As a result, the project team asked the applicant to provide more details on how acceptance criteria will be established.

In its response, the applicant stated that the minimum acceptable tube wall thickness for each heat exchanger to be eddy current inspected will be established based upon a component-specific engineering evaluation based on code requirements, EPRI guidelines, and internal calculations. Wall thickness will be acceptable if greater than the minimum wall thickness for the component. The acceptance criterion for visual inspections of heat exchanger heads, covers, and tubesheets will be no evidence of degradation that could lead to loss of function. If degradation is detected such that if not corrected it would lead to loss of intended function, a condition report will be written and the issue resolved in accordance with the site corrective action program. The project team determined that the applicant's response to this request was acceptable because this approach to establishing acceptance criteria will provide additional assurance that the effects of aging will adequately managed.

On this basis, the project team found that the applicant's description of the "Acceptance Criteria" is acceptable.

3.0.3.3.1.1.7 Corrective Actions

The adequacy of the applicant's 10 CFR 50 Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.7 of the SRP-LR. This program will be administered under the site QA program which meets requirements of 10 CFR Part 50,

Appendix B. On this basis, the project team found that the applicant's description of the "Corrective Actions" is acceptable.

3.0.3.3.1.1.8 Confirmation Process

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.8 of the SRP-LR. **[Project team's evaluation].** On this basis, the project team found that the applicant's description of the "Confirmation Process" is acceptable.

3.0.3.3.1.1.9 Administrative Controls

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.9 of the SRP-LR. [Project team's evaluation]. On this basis, the project team found that the applicant's description of the "Administrative Controls" is acceptable.

3.0.3.3.1.1.10 Operating Experience

The "Operating Experience" program element criteria in Appendix A.1.2.3.10 of the SRP-LR can be summarized as:

> 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.
>
> An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The applicant stated, in the PNPS LRA for the "Operating Experience" program element, that the Heat Exchanger Monitoring Program at PNPS is a new program for which there is no operating experience.

The applicant stated that the Heat Exchanger Monitoring Program at PNPS is a new program for which there is no operating experience. However, operating experience with respect to heat exchanger degradation is available as a result of adherence to GL 89-13. Therefore, the project team asked the applicant to provide operating experience with respect to heat exchanger wall thinning and other degradation resulting from adherence to GL 89-13.

In its response, the applicant stated that GL 89-13 requires inspection of one RBCCW heat exchanger each refuel outage. Service water side inspections have resulted in some minimal tube plugging and weld or belzona repair to washed out areas on the pass partition plate or tube sheet. Past inspections have also identified degraded gasket seating surfaces and tube inlet sleeve erosion that have required repairs. The copper nickel tube degradation is typically due to internal erosion caused by material wedged in the tube and is random in location. There has also been external tube damage in the area impacted by the shell side inlet flow due to vibration. This particular OE is included in the Service Water Integrity Program (SWIP) B.1.28 since it is a heat exchanger in the scope of the SWIP and the OE confirms the effectiveness of the SWIP. In accordance with NEI 95-10, the review of operating experience is used to either confirm the effectiveness of an existing program or identify new site-specific aging effects. For new programs such as the Heat Exchanger Monitoring Program B.1.15, applying this as OE is not required. The project team determined that the applicant's response to this request was acceptable.

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Heat Exchanger Monitoring Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.



3.0.3.3.1.2 <u>UFSAR Supplement</u>

The applicant provided its UFSAR Supplements for the Heat Exchanger Monitoring Program in the PNPS LRA, Appendix A, Section A.2.1.16, which states that the Heat Exchanger Monitoring Program inspects heat exchangers for degradation. If degradation is found, then an evaluation is performed to evaluate its effects on the heat exchanger's design functions including its ability to withstand a seismic event.

Representative tubes within the population of heat exchangers are eddy current tested at a frequency determined by internal and external operating experience to ensure that effects of aging are identified prior to loss of intended function. Along with each eddy current test, visual inspections are performed on accessible heat exchanger heads, covers and tube sheets to monitor surface condition for indications of loss of material. The population of heat exchangers includes the RHR heat exchangers, core spray pump motor thrust bearing lube oil coolers, HPCI gland seal condenser, HPCI turbine lube oil cooler, RCIC lube oil cooler, recirculation pump motor generator set fluid coupling oil and bearing coolers, CRD pump oil coolers, recirculation pump motor lube oil coolers, clean up recirculation pump lube oil coolers and stuffing box cooler, and EDG lube oil coolers.

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).

3.0.3.3.1.3 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.2 INSERVICE INSPECTION - CONTAINMENT INSERVICE INSPECTION (CII) PROGRAM (PNPS AMP B.1.16.1)

In the PNPS LRA, Appendix B, Section B.1.16.1, the applicant described PNPS AMP B.1.16.1, "Inservice Inspection – Containment Inservice Inspection (CII) Program."

The applicant stated that PNPS AMP B.1.16.1 is an existing plant-specific program. The Containment Inservice Inspection Program is a plant-specific program encompassing the requirements for the inspection of Class MC pressure-retaining components (Primary Containment) and their integral attachments in accordance with the requirements of 10 CFR 50.55a(b)(2) and the 1998 Edition of ASME Section XI with 2000 Addenda, Inspection Program B.



The project team reviewed, in whole or part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.16.1 including Aging Management Program Evaluation Report, Revision 1, Section 4.14.2 "Containment Inservice Inspection (CII) Program" and interviewed the applicant's technical staff.

3.0.3.3.2.1 Review of the PNPS AMP B.1.16.1 Against the Program Elements

The project team reviewed PNPS AMP B.1.16.1 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 PNPS audit and review plan.

3.0.3.3.2.1.1 Scope of Program

The "Scope of Program" program element 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.

The applicant stated in PNPS AMP B.1.16.1, for the "Scope of Program" program element, that this program, under ASME Section XI Subsection IWE, manages loss of material for the primary containment and its integral attachments. The primary containment is a General Electric Mark I pressure suppression containment system. The system consists of a drywell (housing the reactor vessel and reactor coolant recirculation loops), a pressure suppression chamber (housing a water pool), and the connecting vent system between the drywell and the water pool, isolation valves, and containment cooling systems. The code of construction for the containment structure is the ASME Section III, 1965 Edition and the latest addenda as of June 9, 1969, including Code Cases 1330-1 and 1177-5.

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

3.0.3.3.2.1.2 Preventive Actions

The "Preventive Actions" program element in Appendix A.1.2.3.2 of the SRP-LR are that (1) the activities for prevention and mitigation programs should be described, and (2) for condition or performance monitoring programs that do not rely on preventive actions, and thus, preventive actions need not be provided.

The applicant stated in PNPS AMP B.1.16.1, for the "Preventive Actions" program element, that this program is a monitoring program that does not include preventive actions. The project team determined that the "Preventive Actions" program element satisfies the criteria defined in Appendix A.1.2.3.2 of the SRP-LR. On this basis, the project team found that the applicant's "Preventive Actions" acceptable.



3.0.3.3.2.1.3 Parameters Monitored/Inspected

The "Parameters Monitored/Inspected" program element in Appendix A.1.2.3.3 of the SRP-LR can be summarized as:

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

The applicant stated in PNPS AMP B.1.16.1, for the "Parameters Monitored/Inspected" program element, that primary containment and its attachments are inspected for evidence of cracks, wear, and corrosion.

The project team determined that the "Parameters Monitored/Inspected" program element satisfies the criteria defined in Appendix A.1.2.3.3 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Parameters Monitored/Inspected" is acceptable.

3.0.3.3.2.1.4 Detection of Aging Effects

The "Detection of Aging Effects" program element in Appendix A.1.2.3.4 of the SRP-LR can be summarized as:

Provide information that links the parameters to be monitored or inspected to the aging effects being managed.

Describe when, where, and how program data are collected (i.e., all aspects of activities to collect data as part of the program).

Link the method or technique and frequency, if applicable, to plant-specific or industry-wide operating experience.

Provide the basis for the inspection population and sample size when sampling is used to inspect a group of SCs. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.



The applicant stated in PNPS AMP B.1.16.1 for the "Detection of Aging Effects" program element that the Containment Inservice Inspection Program manages loss of material for the primary containment and its integral attachments.

The primary inspection method for the primary containment and its integral attachments is visual examination. Visual examinations are performed either directly or remotely with sufficient illumination and resolution suitable for the local environment to assess general conditions that may affect either the containment structural integrity or leak tightness of the pressure-retaining component. The program includes augmented ultrasonic exams to measure wall thickness of the containment structure.

For steel, the Containment Inservice Inspection Program manages loss of material and cracking for ASME Code Class MC pressure-retaining steel components and their integral attachments. This aging effect is managed by visual inspections required by ASME Section XI, Subsection IWE.

The project team determined that this program element satisfies the criteria defined in Appendix A.1.2.3.4 of the SRP-LR. PNPS's drywell interior surfaces are examined for degradation every refueling outage as required by Technical Specification 4.7.A.2.d. Additionally, drywell interior surfaces are examined every other outage in accordance with the PNPS IWE Program. Drywell structures are examined in accordance with ASME Section XI - 1998 Edition with 2000 Addenda, Subsection IWE, requirements for Class MC and metallic Liners of Class CC Components of light-Water Cooled Plants. Since IWE requirements were mandated in 1996, no areas have been identified that exceeded code acceptance criteria on the drywell interior surfaces during these inspections. On this basis, the project team found that the applicant's description of the "Detection of Aging Effects" is acceptable.

3.0.3.3.2.1.5 Monitoring and Trending

The "Monitoring and Trending" program element in Appendix A.1.2.3.5 of the SRP-LR can be summarized as:

> 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 are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The applicant stated in PNPS AMP B.1.16.1, for the "Monitoring and Trending" program element, that results are compared, as appropriate, to baseline data and other previous test results. If indications are accepted for continued use by analytical evaluation, the areas containing such flaws are monitored during successive inspection periods.

The project team determined that for visual inspection, this program element satisfies the criteria defined in Appendix A.1.2.3.5 of the SRP-LR. With the exception of inaccessible areas, all surfaces are monitored by virtue of the examination requirements on a scheduled basis. The monitoring and trending of the drywell shell liner plate are in addition to the current PNPS ASME, Section XI, Subsection IWE procedural requirements. These inspections will provide additional assurance that there is no loss of intended function of the drywell shell. On this basis, the project team found that the applicant's description of the "Monitoring and Trending" is acceptable.

3.0.3.3.2.1.6 Acceptance Criteria

The "Acceptance Criteria" program element in Appendix A.1.2.3.6 of the SRP-LR can be summarized as:

> The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.
>
> The program should include a methodology for analyzing the results against applicable acceptance criteria.
>
> Qualitative 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 stated in PNPS AMP B.1.16.1, for the "Acceptance Criteria" program element, that results are compared, as appropriate, to baseline data, other previous test results, and acceptance criteria of the ASME Section XI, Subsection IWE for evaluation of any evidence of degradation.

The project team determined this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.6 of the SRP-LR. Letter No. 2.06.040, dated May 11, 2006, stated: "...PNPS inspects the liners drains for the water reservoirs on the refuel floor (e.g., spent fuel pool, dryer/separator pool, and reactor cavity) for leakage. Leakage into the liner drain could be a precursor for water leaks, which could wet the drywell shell exterior surface. These drains are examined for leakage after filling the refueling cavity...The code requires owners to identify locations they believe are suspect or potential problem areas for augmented inspection. After a review of PNPS drywell construction methods, PNPS identified various locations for augmented examination. The presence of ethafoam rings left in place at certain elevations of the drywell caused a concern that they could trap and hold leakage from the bellows or fuel pool and cause corrosion of the shell outer surface. For this reason, augmented UT examinations in the upper drywell at elevation 72 feet and 83 feet (four locations at each elevation) were performed in vertical trips to ensure the region of interest was examined. The examinations performed in 1999 and 2001 revealed no degradation of the drywell shell thickness in the upper drywell. UT thickness examinations will continue to be performed under PNPS IWE Program at two locations in the upper drywell immediately adjacent to the fuel pool due to the potential for leakage from the fuel pool liner. The drywell shell to floor joint is inspected under the PNPS IWE Program. On this basis, the project team found that the applicant's description of the "Acceptance Criteria" is acceptable.

3.0.3.3.2.1.7 Corrective Actions

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.7 of the SRP-LR. The project team evaluated the applicant's statement in PNPS AMP B.1.16.1 for the "Corrective Actions" program element involving components whose examination results (following a Subsection IWE inspection) show flaws or areas of degradation that do not meet the acceptance standards. The applicant stated that these flaws or areas of degradation are acceptable if an engineering evaluation indicates they are nonstructural in nature or have no effect on the structural integrity of the containment. Except as permitted by 10 CFR 50.55a(b)(ix)(D) components that do not meet the acceptance standards are subject to additional examination requirements, and the components are repaired or replaced to the extent necessary to meet the acceptance standards. On this basis, the project team found that the applicant's description of the "Corrective Actions" is acceptable.

3.0.3.3.2.1.8 Confirmation Process

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.8 of the SRP-LR. The project team evaluated the site quality assurance (QA) procedures, review and approval processes, and administrative controls which are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The PNPS Quality Assurance Program applies to safety-related structures and components. Corrective actions and administrative (document) control for both safety-related and nonsafety-related structures and components are accomplished per the existing PNPS Corrective Action Program and the PNPS Document Control Program.

The confirmation process is part of the Corrective Action Program and includes reviews to assure that proposed actions are adequate, tracking and reporting of open corrective actions, and review of corrective action effectiveness. Any follow-up inspection required by the confirmation process is documented in accordance with the Corrective Action Program. The Corrective Action Program constitutes the confirmation process for the PNPS aging management programs and activities. The PNPS confirmation process is consistent with NUREG-1801. On this basis, the project team found that the applicant's description of the "Confirmation Process" is acceptable.

3.0.3.3.2.1.9 Administrative Controls

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.9 of the SRP-LR. The project team evaluated site quality assurance (QA) procedures and review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The PNPS Quality Assurance Program applies to safety-related structures and components. Administrative (document) control for both safety-related and nonsafety-related structures and components is accomplished per the existing PNPS Document Control Program. The PNPS administrative controls are consistent with NUREG-1801. On this basis, the project team found that the applicant's description of the "Administrative Controls" is acceptable.

3.0.3.3.2.1.10 Operating Experience

The "Operating Experience" program element criteria in Appendix A.1.2.3.10 of the SRP-LR can be summarized as:

> 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 may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The applicant stated, in the PNPS LRA, for the "Operating Experience" program element, that in 1999, the below-water regions of all 16 torus bays as well as the drywell to torus vent areas with water accumulation were inspected. Results revealed areas of defects such as depleted zinc, localized pitting corrosion, and minor surface rusting. Degraded areas were re-coated to prevent further corrosion and re-examined. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

**Pilgrim Nuclear Power Station Audit and Review Report**

An IWE visual exam in 1999 detected loose torus anchor bolt extensions and base plate corrosion exceeding acceptance criteria. Bolt extensions were tightened. Corrosion was accepted by evaluation. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

During RFO14 (April 2003) ultrasonic thickness examination of the torus shell, several measurements were below the nominal wall thickness of 0.629". Since the measurements were all greater than the minimum allowable thickness of 0.563", no further action was taken. CII examinations will continue to monitor thickness of the torus shell. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

Results of the CII general visual walkdown of primary containment during RFO14 (April 2003) were compared with those from the previous inspection. The only new indication was in the CRD penetration area, where there is some surface corrosion but it is not significant and is structurally acceptable. No significant corrosion was found in other areas. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

CII inspections during RFO15 (April 2005) did not reveal evidence of loss of material. Absence of degradation provides evidence that the program is effective for managing aging effects.



Oyster Creek experienced drywell corrosion due to salt-water intrusion. To ensure the same problem did not exist at PNPS, augmented IWE UT inspections were performed.

A QA audit and an NRC inspection in spring 2005 revealed no issues or findings that could impact the effectiveness of the program.

The project team reviewed the 1999 IWE underwater visual examinations that revealed approximately 80 percent of the surfaces to be in fairly good condition with sporadic coating defects (localized corrosion with pitting) identified in the remaining areas. Corrosion of the torus underwater surfaces is attributed to local zinc depletion in the zinc-rich protective coating. Pit depth measurements were taken and documented in the SG Pinney report and PR99.1345. All areas with pit depths measurements at 0.032" and greater were re-coated with qualified coating. One pit exceeded the maximum allowable depth of 0.066". This was determined to be a preservice gouge in the torus shell plate and was subsequently accepted by evaluation. None of the 1999 inspection results of torus underwater surfaces were considered significant (PR99.1345 response). The current general corrosion rates determined from inspection data collected since 1991 will not result in pitting corrosion that would violate the general minimum wall thickness values for the torus shell by the end of the period of extended operation.

Preventive actions to deter recurrence of pitting consist of coating repairs with qualified coating and periodic inspections associated with the torus desludge project every other outage. The IWE VT-3 visual examination of submerged surfaces is also performed every 10 years in accordance with the PNPS IWE Program.

Augmented IWE visual examinations of selected portions of the drywell to torus vent system in 1999 revealed localized pitting due to degradation of the coating aggravated by standing water in the downcomer vent bowls (vent bowl drains had been cut and capped in a previous modification for seismic considerations). The scope of the examinations was expanded to include all eight vents. All pitting was evaluated and found to be acceptable. The surfaces were prepped and recoated with a qualified coating to prevent recurrence of the corrosion.

The project team reviewed the loose condition of the two torus saddle support tie-down nuts that was discovered during a schedule PNPS IWE program visual examination of containment supports in 1999. Corrective actions included re-torque of the two loose tie-down nuts to 80 ft-lbs. and checking the tightness of a sample of the remaining tie-down nuts. No other loose bolting conditions were identified. The tightness of the support tie-down nuts is unrelated to torus anchor bolt tension as the upper tie-down bolting connects the torus saddle support to the free upper end of the anchor bolt and is not used to tension the anchor bolt to the concrete floor. The cause of the two loose tie-down nuts may be indeterminate given the information available at this point in time. However, the loose nuts condition is not significant because the safety function of the torus saddle support tie-down nuts is to prevent vertical movement of the torus from a hydrodynamic event occurring during accident conditions. The 80 ft-lbs for these nuts are intended to ensure the nuts remain in a flush condition with the saddle support-bearing surface. As long as no gap exits between the tie-down nuts and the torus saddle support bearing surface, the support will perform the intended safety function. No gaps were identified between the two loose nuts found in 1999 and saddle support surfaces.

The design document review form SUDDS/RF99-134 indicated that the ground-water intrusion through the torus floor had not significantly degraded the tensile strength of the rock anchor bolts base on chemical testing of the ground water. The reduction (less than 1 percent) does not affect the original analysis (Teledyne Calculation 5310F-23) conclusion that concrete pullout is the controlling failure mode. The corrosion which has occurred up to this point is considered insignificant and is not expected to increase due to the following: (1) the high pH (9.5) of the standing water would indicate the formation of protective oxides on the bolts; (2) absence of concrete cracking or spalling around the bolts indicates no active corrosion cells; and (3) low chloride content (less than 1 ppm) in the water. High chloride level can break the protective oxide layer and allow further corrosion.

The applicant stated that the PNPS monitors torus wall thickness via the inclusion of augmented UT thickness examinations in the PNPS IWE Program. These thickness examinations are performed at eight locations distributed around the torus. Half of the inspections are performed at the torus vapor/water interface of the torus shell while the other half are performed at a location approximately halfway between the waterline and the lowest point on the torus shell. Torus shell thickness examinations are performed during each 40-month period (i.e., every other outage) while the plant is on-line. Comparison of UT results from 1999 and 2003 reveal no measurable change in wall thickness. These examinations will continue to be performed by qualified NDE technicians who are code certified to at least level II in ultrasonic thickness measurement.

The applicant also stated that the findings from the IWE General Visual Walkdown performed during RFO14 are evaluated and dispositioned in CR-PNP-2003-01618. Newly reported corrosion around the CRD penetrations at the 270-degree azimuth at approximately 35 feet elevation in the drywell was re-checked visually by the IWE Responsible/Design engineer and found acceptable. This was characterized as surface corrosion that was not considered significant by the Responsible/Design engineer. Since the determination was made that the corrosion was acceptable, no root cause analysis was performed and no corrective or preventive actions were required. Acceptance criteria for the General Visual Walkdown are detailed in PNPS Procedure 2.1.8.7 and Entergy Engineering Standard ENN-EP-S-001, Section 5. Conditions listed as requiring evaluation include, in part, peeling, flaking, blistering, cracking, checking, absence of coating, and rust bleed out on the containment coating.

In the letter dated May 11, 2006, letter number 2.06.040, the applicant stated that no leakage-causing moisture in the vicinity of the sand cushion at PNPS has been observed, and no moisture has been detected or is suspected on the inaccessible areas of the drywell shell. Further, any potential leakage through the refueling bellows assembly is directed to a drain system. Therefore, no additional components have been identified that require aging management review as a source of moisture that may affect the drywell shell in the lower region.

As stated in the response to GL 87-05, PNPS performed UT thickness measurements of the drywell shell in January 1987. The UT thickness measurements were taken at 12 locations directly above the sand cushion region. These measurements detected no loss of wall thickness.



PNPS verified that the annulus air gap drain lines are unobstructed. In 1987, access holes were machined in the drain line elbows on all four-drain lines to allow access for remote visual examination using fiber scopes. This inspection determined that the four annulus air gap drains are unobstructed and found no signs of corrosion on visible portions of the drywell surface.

PNPS monitors the annulus air gap drains during every refueling outage.

PNPS performed additional UT thickness measurements adjacent to the sand cushion region at the 9 foot 1 inch elevation in 1989 and 2001. The sand cushion region of the drywell shell is inaccessible unless concrete is removed. For the examinations in 1999 and 2001, concrete at the periphery of the 9 foot 2 inch elevation was chipped away to allow UT wall thickness measurements of the drywell shell to be taken at the level of the upper sand cushion. These examinations are destructive in nature and are performed in a high-radiation area. The areas were then re-grouted prior to resuming operations. The observed wall thickness reading showed the drywell wall thickness in these areas to be essentially as built. Based on the four factors, PNPS removed UT thickness measurements in the sand cushion region from the IWE program after the 2001 outage: (1) satisfactory results from monitoring for leakage from the annulus air gap drains; (2) satisfactory drywell wall thickness at the 9 foot 1 inch elevations and cushions region (and upper drywell) after 27 years of operation (as of 1999); (3) high radiation exists in areas of sand cushion UT exam; and (4) the potential for damage to the drywell shell from concrete removal tools used to facilitate the examinations.

The following ongoing actions are being taken to prevent and identify drywell corrosion: (1) PNPS monitors the four annulus air gap drains twice every refueling outage, once after floodup, and again prior to flooddown at the end of the outage; (2) leakage has never been detected from the annulus air gap drains at PNPS; (3) functional checks are performed each refueling outage on the flow switch associated with the bellows seal leakage monitoring system; and (4) drywell interior surfaces are examined for degradation every refueling outage as required by Technical Specification 4.7.A.2.d. Additionally, drywell interior surfaces are examined every other outage in accordance with the PNPS IWE Program. Drywell structures are examined in accordance with ASME Section XI - 1998 Edition with 2000 Addenda, Subsection IWE, requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Plants. Since IWE requirements were mandated in 1996, no areas have been identified that exceeded code acceptance criteria on the drywell interior surfaces during these inspections.
PNPS inspects the liners drains for the water reservoirs on the refuel floor (e.g., spent fuel pool, dryer/separator pool, and reactor cavity) for leakage. Leakage into the liner drain could be a precursor for water leaks, which could wet the drywell shell exterior surface. These drains are examined for leakage after filling the refueling cavity.

Paragraph IWE-1242 of the ASME Section XI code states that surface areas likely to experience accelerated degradation and aging require augmented examination. These examinations are included in the PNPS ISI Program along with other containment examinations. The IWE requirements for augmented examination are required by 10 CFR 50.55a.

The code requires owners to identify locations they believe are suspect or potential problem areas for augmented inspection. After a review of PNPS drywell construction methods, PNPS identified various locations for augmented examination. The presence of ethafoam rings left in place at certain elevations of the drywell caused a concern that they could trap and hold leakage from the bellows or fuel pool and cause corrosion of the shell outer surface. For this reason, augmented UT examinations in the upper drywell at elevation 72 feet and 83 feet (four locations at each elevation) were performed in vertical strips to ensure the region of interest was examined. The examinations performed in 1999 and 2001 revealed no degradation of the drywell shell thickness in the upper drywell. UT thickness examinations will continue to be performed under the PNPS IWE program at two locations in the upper drywell immediately adjacent to the fuel pool due to the potential for leakage from the fuel pool liner. The drywell shell to floor joint is inspected under PNPS IWE Program.

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Containment Inservice Inspection Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.3.2.2 UFSAR Supplement

The applicant provided its UFSAR Supplements for the Containment Inservice Inspection Program in the PNPS LRA, Appendix A, Section A.2.1.17, which states that the Heat Exchanger Monitoring Program outlines the requirements for the inspection of Class MC pressure-retaining components (primary containment) and their integral attachments in accordance with the requirements of 10 CFR 50.55a(b)(2) and the 1998 Edition of ASME Section XI with 2000 Addenda, Inspection Program B.

The primary inspection method for the primary containment and its integral attachments is visual examination. Visual examinations are performed either directly or remotely with illumination and resolution suitable for the local environment to assess general conditions that may affect either the containment structural integrity or leak tightness of the pressure-retaining component. The program includes augmented ultrasonic exams to measure wall thickness of the containment drywell structure.

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).

3.0.3.3.2.3 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.3 INSERVICE INSPECTION – INSERVICE INSPECTION (ISI) PROGRAM (PNPS AMP B.1.16.2)

In the PNPS LRA, Appendix B, Section B.1.16.2, the applicant described PNPS AMP B.1.16.2, "Inservice Inspection – Inservice Inspection (ISI) Program."

The applicant stated that PNPS AMP B.1.16.2 is an existing plant-specific program encompassing ASME Section XI, Subsections IWA, IWB, IWC, IWD, and IWF requirements. The applicant stated that the Inservice Inspection Program is based on ASME Inspection Program B (IWA-2432), which has 10-year inspection intervals and that every 10 years, the program is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50.55a. The applicant stated that on July 1, 2005, PNPS entered the fourth ISI interval. The applicant stated that the ASME code edition and addenda used for the fourth interval is the 1998 edition with 2000 addenda and the current program ensures that the structural integrity of Class 1, 2, and 3 systems and associated supports is maintained at the level required by 10 CFR 50.55a.

The project team reviewed, in whole or part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.16.2 including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.14.1, "Inservice Inspection (ISI) Program," and interviewed the applicant's technical staff.

The project team also reviewed PNPS Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.15, "Inservice Inspection (ISI) Program;" PNPS-RPT-05-001, Revision 0, "Fourth 10-Year ISI Program Plan" (ML051920157); ASME Section XI, 2001 edition with 2002 and 2003 addenda; and ASME Section XI, 1998 edition with 2000 addenda.

3.0.3.3.3.1 Review of the PNPS AMP B.1.16.2 Against the Program Elements

The project team reviewed PNPS AMP B.1.16.2 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 review process as described in the PNPS audit and review plan.

3.0.3.3.3.1.1 Scope of Program

The "Scope of Program" program element 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.

The applicant stated in PNPS AMP B.1.16.2, for the "Scope of Program" program element, that this program manages cracking, loss of material, and reduction of fracture toughness of reactor coolant system piping, components, and supports. The program implements applicable requirements of ASME Section XI, Subsections IWA, IWB, IWC, IWD, and IWF, and other requirements specified in 10 CFR 50.55a with approved NRC alternatives and relief requests. Every 10 years the ISI Program is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50.55a.

The applicant stated that ASME Section XI inspection requirements for Reactor Vessel Internals (Subsection IWB, Categories B-N-1 and B-N-2) are not in the ISI Program, but are included in the BWR Vessel Internals Program.

During the audit and review, the project team asked the applicant to identify any exceptions or alternatives to the requirements of ASME Section XI, 1998 edition with 2000 addenda that have been granted or imposed under provisions of 10 CFR 50.55a. In response to this request, the applicant provided a list of nine relief requests related to inservice inspections at PNPS during the fourth 10-year interval which expires on June 30, 2015, approximately 3 years into the period of extended operation. The applicant stated that technical justifications for these exceptions or alternatives are included in PNPS-RPT-05-001, "Fourth 10-Year ISI Program Plan" (ML051920157). The project team reviewed each of the relief requests and the associated technical justification and found each of them either acceptable for aging management or to have no effect on aging management during the period of extended operation. A summary of the project's team's evaluation of relief requests is provided in the following paragraphs:

PNPS Relief Request PRR-2

Alternate Criteria for Class 1 Pressure Tests of Piping, Pumps, and Valves (Category B-P, Items Number B15.10, B15.50, B15.60 and B15.70).

Evaluation of Effects on License Renewal: This relief request applies for ASME Section XI, Examination Category B-P (all pressure retaining components). The code requirement is to perform the pressure test at a pressure not less than the nominal pressure associated with 100 percent rated reactor power. The nominal 100 percent pressure is 1035 psig. The requested relief permits PNPS to perform the test at a nominal pressure of 930 psig, which is the pressure at 5 percent reactor power, just prior to inerting the drywell.

The relief was requested because of the impracticality of performing the full pressure test at 100 percent power due high radiation level, high heat, and an inerted drywell. An alternative to the relief would be for PNPS to perform a hydrostatic test with the reactor shutdown, which the applicant says would provide marginal additional benefit and have a large detrimental effect on outage duration.

Based upon review of the applicant's technical justification, the project team determined that the required type of test will still be performed for the components to which it is applicable, only at a somewhat lower test pressure, and that provisions for leakage monitoring during operation, and requirements to shutdown if leakage is excessive, will assure that operation will not continue if there was noticeable leakage that manifested itself only above the 930 psig pressure point. On this basis, the project team determined that this relief request, if approved in accordance with 10 CFR 50.55a, will be acceptable during the period of extended operation.



PNPS Relief Request PRR-4

Relief from leakage testing of 1 inch and less vent and drain lines and valves. Examination Category B-P, Items B15.50 and B15.70, require the system leakage test to include all ASME Code Class 1 components within the system boundary.

Evaluation of Effects on License Renewal: This relief request applies for ASME Section XI, Examination Category B-P (all pressure retaining components), Items B15.50 (piping), and B15.70 (valves). The code requirement is to test all Code Class 1 piping and valves within the reactor coolant pressure boundary (RCPB) during the system leakage test. The requested relief permits the system leakage test to be performed with vent, drain, and branch line valves in their normal operating position. Since vent and drain lines have two normally closed RCPB valves, performing the test with the valves in their normal operating position results in the outboard valve and the pipe connecting to the inboard valve not being tested (provided the inboard valve is not leaking) or results in potential leakage through the inboard valve not being detected (provided the outboard valve and connecting pipe are not leaking).

Relief was requested due to the personnel hazards associated with performing the test as specified and the time involved to perform the test and re-establish operational valve alignments. The applicant's technical justification stated that testing each individual valve separately would provide little additional benefit.

Based upon review of the applicant's technical justification, the project team determined that the required type of test will still be performed for the components to which it is applicable; however, the components will not all be in the test configuration specified in ASME Section XI. The project team also determined that provisions for leakage monitoring during operation, and requirements to shutdown if leakage is excessive, will assure that operation will not continue if there was noticeable leakage that manifested itself later in the operating cycle. On this basis, the project team determined that this relief request, if approved in accordance with 10 CFR50.55a, will be acceptable during the period of extended operation.

<u>PNPS Relief Request PRR-5</u>

Relief from Supplement 10 for examination of Category B-F dissimilar metal (DSM) welds. The Final Rule, 64 FR 51370, dated 09/22/1999, required PNPS to implement a program to comply with Supplement 10 by 11/22/2002. Supplement 10 contains the qualification requirements for procedures, equipment, and personnel involved with examining DSM welds using ultrasonic techniques.

<u>Evaluation of Effects on License Renewal</u>: The applicant's technical justification states that this relief request allows a number of changes in details of the qualification requirements for dissimilar pipe welds as set forth in ASME Section XI, Appendix VIII, Supplement 10, "Qualification Requirement for Dissimilar Metal Piping Welds." The technical justification identifies changes that affect the test specimen requirements and the conduct of performance demonstration for the process whereby procedures, equipment, and personnel are qualified for detecting flaws in components subject to examination. The project team noted that this relief does not affect the scope or timing of component examination, nor the parameters monitored or the ability to detect aging effects in the examined components. On this basis, the project team determined that this relief request, if approved in accordance with 10 CFR 50.55a, will be acceptable during the period of extended operation.

<u>PNPS Relief Request PRR-9</u>

Relief from ASME Code Section XI, Appendix VIII, Supplement 11 for pressure retaining piping weld overlay examinations.

<u>Evaluation of Effects on License Renewal</u>: The applicant's technical justification stated that this relief request makes a number of changes in details of the qualification requirement for full structural overlay welds as set forth in ASME Section XI, Appendix VIII, Supplement 11, "Qualification Requirement for Full Structural Overlaid Wrought Austenitic Piping Welds." The technical justification identifies changes that affect the test specimen requirements, the conduct of performance, and the acceptance criteria whereby procedures, equipment, and personnel are qualified for detecting flaws in components subject to examination. The project team noted that this relief does not affect the scope or timing of component examination, nor the parameters monitored or the ability to detect aging effects in the examined components. On this basis, the project team determined that this relief request, if approved in accordance with 10 CFR 50.55a, will be acceptable during the period of extended operation.

PNPS Relief Request PRR-10

Risk Informed ISI (RI-ISI): Relief Related to Category B-F and B-J Weld Examinations.

Evaluation of Effects on License Renewal: The applicant's technical justification stated that this relief request applies for ASME Section XI, Examination Category B-F (pressure-retaining dissimilar metal welds in vessel nozzles) and Examination Category B-J (pressure-retaining welds in piping) in Class 1 components, and that the relief request does not apply for Class 2 or Class 3 components. The requested relief allows the use of risk-informed criteria to reduce the number of Category B-F and Category B-J components that are examined to the requirement specified in ASME Section XI, Table IWB-2500-1, for examination categories B-F and B-J.

The project team asked the applicant to provide a comparison of the number of category B-F weld inspections and category B-J weld inspections before and after implementation of risk-informed selection criteria in their ISI program. In response to this request, the applicant provided the following information:

> Code Category B-F: There are a total of 40 B-F welds in the ISI program. Before RI-ISI implementation, there were 40 weld exams; and after RI-ISI there are now 11 weld exams.
>
> Code Category B-J: There are a total of 598 B-J welds in the ISI program. Before RI-ISI implementation, there were 156 weld exams [25 percent of the total]; after RI-ISI, there are now 60 welds examined.



In addition to ISI program welds, there are augmented IGSCC BWRVIP-75A program welds examined. For the IGSCC category B through G welds examined per BWRVIP-75A, there are 16 category B-F welds and 18 category B-J welds.

Based on the applicant's information, the project team determined that examination of Category B-F welds decreased from 40 welds to 27 welds and that examination of Category B-J welds decreased from 156 welds to 78 welds. The project team noted that a substantial number of welds of identical materials and environments in each weld examination category continue to be examined, and that the evaluation process includes provisions for sample size expansion if unacceptable flaws are found. On this basis, the project team determined that the applicant will continue to provide acceptable aging management of Category B-F and B-J welds by monitoring the aging of sample welds during the period of extended operation. Because acceptable aging management continues to be provided, the project team determined that inclusion of this relief request in the applicant's site-specific ISI program, if approved in accordance with 10 CFR 50.55a, will be acceptable during the period of extended operation.

PNPS Relief Request PRR-10

Relief from code reactor pressure vessel (RPV) flange-to-shell weld UT exam requirements conducted in accordance with Article 4 of ASME Section V, supplemented by requirement of Table I-2000-1.

Evaluation of Effects on License Renewal: This relief request applies to the method used for examination of the RPV flange-to-shell welds. ASME Section XI, Appendix I, requires that the flange-to-shell weld, Examination Category B-A, be conducted in accordance with methods qualified to ASME Section V, supplemented by requirements of Table I-2000-1. The applicant's technical justification states that the flange-to-vessel weld and the flange-to-head welds are the only welds at PNPS for which examination is not qualified to ASME Section XI, Appendix VIII. The technical justification states that this relief allows PNPS to qualify the examination for Category B-A welds to requirements of ASME Section XI, Appendix VIII. The project team determined that this relief request affects the requirements for examination qualification; however, it does not change the examination requirements in terms of components examined, timing of examination, or parameters that are monitored. On the basis that the requested relief affects only the examination qualification, but not the general scope of the examination nor the ability of the examination to detect aging effects and to manage aging of the examined components, the project team determined that this relief request, if approved in accordance with 10 CFR 50.55a, will be acceptable during the period of extended operation.

PNPS Relief Request PRR-15

Alternative contingency repair plan for RPV nozzle safe end and dissimilar metal piping welds using ASME Code Cases N-638 and N-504-2 with exceptions.

Evaluation of Effects on License Renewal: This relief request applies for a contingency repair of six specific, safe, end-to-nozzle welds using a full structural overlay repair. The applicant's relief request states that the requirement for such weld repairs is for the weld overlays to be designed consistent with the requirements of NUREG-0313 (which was implemented by Generic Letter 88-01), ASME Code Cases N-504-2, N-638, and ASME Section XI, Paragraph IWB-3640. The requested relief will allow the repair to utilize ASME Code Case N-540-2 and Code Case N-638 with certain exceptions and clarifications.

Regulatory Guide 1.147, Revision 14, "Inservice Inspection Code Case Acceptability," lists Code Case N-504-2 and Code Case N-638-1 (which superseded N-638) as conditionally acceptable ASME Section XI code cases. The applicant's relief request states that weld overlays involve the application of weld metal circumferentially over and in the vicinity of a flawed weld to restore ASME Section XI margins as required by ASME Code Case N-504-2. It states that weld overlays have been used in the nuclear industry as an acceptable method to repair flawed welds and that the use of overlay filler material that is resistant to intergranular stress corrosion cracking provides an effective barrier to crack extension.

The project team determined that the relief request is a contingency for repair. It does not affect the examinations required for ASME Section XI components nor does it affect the parameters monitored for the detection of aging effects. On the basis that monitoring for, and detection of, aging effects is not affected by this relief request, the project team determined that this relief request, if approved in accordance with 10 CFR 50.55a, will be acceptable during the period of extended operation.

PNPS Relief Request PRR-28

Alternative to examination requirement for RPV circumferential shell welds (Item B1.10 of Examination Category B-A). This relief request was approved for the third 10-year ISI interval, and it expires on June 8, 2012.

Evaluation of Effects on License Renewal: The applicant stated that this relief request expires on June 8, 2012, which is prior to the period of extended operation. On the basis that this relief request expires prior to the period of extended operation, the project team finds that it has no effect on license renewal and, therefore, it is acceptable.

PNPS Relief Request PRR-39

Full structural weld overlay contingency repairs for the welds associated with austenitic RPV nozzle safe end and dissimilar metal piping welds. This relief request was approved for the third 10-year ISI interval, and it expires on June 8, 2012.

Evaluation of Effects on License Renewal: The applicant stated that this relief request expires on June 8, 2012, which is prior to the period of extended operation. On the basis that this relief request expires prior to the period of extended operation, the project team finds that it has no effect on license renewal and, therefore, it is acceptable.

On the basis of the preceding evaluations, the project team determined that each of the listed PNPS relief requests, if approved in accordance with 10 CFR 50.55a, will be acceptable during the period of extended operation.



During the audit and review, the project team noted that the applicant's "Scope of Program" description provides a summary description of the types of components that are included within the scope of the program and that ASME Section XI, which is incorporated by reference in the "Scope of Program" description, provides detailed listings of the components that are included.

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

3.0.3.3.3.1.2 Preventive Actions

The "Preventive Actions" program element in Appendix A.1.2.3.2 of the SRP-LR are that (1) the activities for prevention and mitigation programs should be described, and (2) for condition or performance monitoring programs that do not rely on preventive actions, and thus, preventive actions need not be provided.

The applicant stated in PNPS AMP B.1.16.2, for the "Preventive Actions" program element, that this program is a condition monitoring program that does not include preventive actions.

During the audit and review, the project team noted the applicant's statement that PNPS's plant-specific ISI program encompasses the requirements of ASME Section XI, Subsections IWB, IWC, IWD, and IWF, which are described in the GALL Report; Appendix XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD; and Appendix XI.S3, ASME Section XI, Subsection IWF, respectively. The project team reviewed the "preventive action" program element as described in the GALL Report, Appendix XI.M1 and Appendix XI.S3, respectively. The project team noted that in GALL Report, Appendix XI.M1, "preventive actions" are described as "operation within the limits prescribed in the Technical Specifications" and that in GALL Report, Appendix XI.S3, "preventive actions" are described as "no preventive actions are specified." The project team determined that for the PNPS site-specific ISI Program, the applicant's "preventive actions" program element matches the description of "preventive actions" for GALL Report, Appendix XI.S3, and that continued operation during the period of extended operation will require operation within the limits prescribed in the Technical Specifications, which is consistent with the "preventive actions" for GALL Report, Appendix XI.M1. On the basis that the "preventive actions" in the applicant's plant-specific ISI Program are consistent with "preventive actions" described in the GALL Report for programs encompassed by the applicant's program, the project team found this element of the applicant's plant-specific program to be acceptable.

The project team determined that the "Preventive Actions" program element satisfies the criteria defined in Appendix A.1.2.3.2 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Preventive Actions" program element is acceptable.



3.0.3.3.3.1.3 Parameters Monitored/Inspected

The "Parameters Monitored/Inspected" program element in Appendix A.1.2.3.3 of the SRP-LR can be summarized as:

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

The applicant stated in PNPS AMP B.1.16.2, for the "Parameters Monitored/Inspected" program element, that the program uses nondestructive examination (NDE) techniques to detect and characterize flaws. The applicant stated that volumetric examinations such as radiographic, ultrasonic, or eddy current examinations are used to locate surface and subsurface flaws. Surface examinations, such as magnetic particle or dye penetrant testing, are used to locate surface flaws.

The applicant stated that three levels of visual examinations are specified. VT-1 visual examination is conducted to assess the condition of the surface of the part being examined, looking for cracks and symptoms of wear, corrosion, erosion or physical damage. It can be done with either direct visual observation or with remote examination using various optical and video devices. The applicant stated that VT-2 visual examination is conducted specifically to locate evidence of leakage from pressure-retaining components (period pressure tests). While the system is under pressure for a leakage test, visual examinations are conducted to detect direct or indirect indication of leakage. The applicant stated that VT-3 visual examination is conducted to determine general mechanical and structural condition of components and supports and to detect discontinuities and imperfections.

During the audit and review, the project team noted the applicant's statement that PNPS's plant-specific ISI program encompasses the requirements of ASME Section XI, Subsections IWB, IWC, IWD and IWF, which are described in the GALL Report; Appendix XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD; and Appendix XI.S3, ASME Section XI, Subsection IWF, respectively. The project team reviewed the "parameters monitored/inspected" program element as described in the GALL Report, Appendix XI.M1 and Appendix XI.S3, respectively. The project team noted that in GALL Report, Appendix XI.M1, "parameters monitored/inspected" are described by reference to ASME Section XI, Tables IWB-2500-1, IWC-2500-1 and IWD-2500-1, respectively, for Class 1, 2, or 3 components. In the GALL Report, Appendix XI.S3, "parameters monitored/inspected" are described by reference to ASME Section XI, paragraph IWF-2500 and Table IWF-2500-1. The project team determined that for the PNPS site-specific ISI Program, the applicant's "parameters monitored/inspected" program element includes a description of the parameters monitored or inspected and of the examination techniques used. In addition, since it is based on the ASME Section XI code, the ASME Section XI sections and tables that are referenced in the GALL Report of this program element are included in the applicant's plant-specific ISI program. On the basis that the "parameters monitored/inspected" in the applicant's plant-specific ISI Program are consistent with "parameters monitored/inspected" as described in the GALL Report for programs encompassed by the applicant's program, the project team found this element of the applicant's plant-specific program to be acceptable.

The project team determined that the "Parameters Monitored/Inspected" program element satisfies the criteria defined in Appendix A.1.2.3.3 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Parameters Monitored/Inspected" program element is acceptable.

3.0.3.3.3.1.4 Detection of Aging Effects

The "Detection of Aging Effects" program element in Appendix A.1.2.3.4 of the SRP-LR can be summarized as:

> Provide information that links the parameters to be monitored or inspected to the aging effects being managed.

Describe when, where, and how program data are collected (i.e., all aspects of activities to collect data as part of the program).

Link the method or technique and frequency, if applicable, to plant-specific or industry-wide operating experience.

Provide the basis for the inspection population and sample size when sampling is used to inspect a group of SCs. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.

The applicant stated in PNPS AMP B.1.16.2 for the "Detection of Aging Effects" program element that the Inservice Inspection (ISI) Program manages cracking and loss of material, as applicable, for carbon steel, low-alloy steel, and stainless steel/nickel-based-alloy subcomponents of the reactor pressure vessel using NDE techniques specified in ASME Section XI, Subsections IWB, IWC, and IWD examination categories.

The applicant stated that the ISI Program manages cracking, loss of material, and reduction of fracture toughness, as applicable, of reactor coolant system components using NDE techniques specified in ASME Section XI, Subsections IWB, IWC, and IWD examination categories.

The applicant stated that the ISI Program manages loss of material for ASME Class MC and Class 1, 2, and 3 piping and component supports and their anchorages by visual examination of components using NDE techniques specified in ASME Section XI, Subsection IWF examination categories.

The applicant also stated that no aging effects requiring management are identified for lubrite sliding supports. However, the applicant stated that the ISI Program will confirm the absence of aging effects for the period of extended operation.

During the audit and review, the project team noted the applicant's statement that PNPS's plant-specific ISI program encompasses the requirements of ASME Section XI, Subsections IWB, IWC, IWD, and IWF, which are described in the GALL Report; Appendix XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD; and Appendix XI.S3, ASME Section XI, Subsection IWF, respectively. The project team reviewed the "detection of aging effects" program element as described in the GALL Report, Appendix XI.M1 and Appendix XI.S3, respectively. The project team noted that GALL Report, Appendix XI.M1, "Detection of Aging Effects," provides a discussion of the extent and schedule of the inspection and test techniques prescribed by the program and describes the component examination categories for Class 1, Class 2, and Class 3 components by reference to ASME Section XI, Tables IWB-2500-1, IWC-2500-1 and IWD-2500-1, respectively. In addition, GALL Report, Appendix XI.S3, "Detection of Aging Effects" provides a brief discussion of VT-3 examination techniques, with a reference to ASME Section XI, paragraph IWF-2500 and Table IWF-2500-1. The project team determined that for PNPS's site-specific ISI Program, the applicant's "Detection of Aging Effects" program element includes a general description of the components included in the program and identifies the aging effects managed by the program, including references to applicable subsections of

ASME Section XI consistent with what is in the GALL Report's descriptions of the program element. On the basis that the "Detection of Aging Effects" program element in the applicant's plant-specific ISI Program is consistent with the "Detection of Aging Effects" program element as described in the GALL Report for programs encompassed by the applicant's program, the project team found this element of the applicant's plant-specific program to be acceptable.

The project team determined that the "Detection of Aging Effects" program element satisfies the criteria defined in Appendix A.1.2.3.4 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Detection of Aging Effects" program element is acceptable.

3.0.3.3.3.1.5 <u>Monitoring and Trending</u>

The "Monitoring and Trending" program element in Appendix A.1.2.3.5 of the SRP-LR can be summarized as:

> 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 are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The applicant stated in PNPS AMP B.1.16.2, for the "Monitoring and Trending" program element, that results are compared as appropriate to baseline data and other previous test results and that if indications are accepted for continued use by analytical evaluation, the areas containing such flaws are monitored during successive inspection periods.

The applicant stated that ISI results are recorded every operating cycle and provided to the NRC after each refueling outage via Owner's Activity Reports prepared by the ISI Program Coordinator. The applicant also stated that these detailed reports include scope of inspection and significant inspection results.

During the audit and review, the project team noted the applicant's statement that PNPS's plant-specific ISI program encompasses the requirements of ASME Section XI, Subsections IWB, IWC, IWD, and IWF, which are described in the GALL Report; Appendix XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD; and Appendix XI.S3, ASME Section XI, Subsection IWF, respectively. The project team reviewed the "Monitoring and Trending" program element as described in the GALL Report, Appendix XI.M1 and Appendix XI.S3, respectively. The project team noted that GALL Report, Appendix XI.M1, "Monitoring and Trending" provides, for Class 1, 2, and 3 components, a discussion of the inspection schedules by reference to IWB-2400, IWC-2400, and IWD-2400, respectively, and of extent and frequency by reference to IWB-2500-1, IWC-2500-1, and IDW-2500-1, respectively. The project team also noted that evaluation of degradation was referenced to IWB-3100, IWC-3100, and IWD-3100; that reexamination was referenced to IWB-2410, IWC-2410, and IWD-2410; and that additional examinations were referenced to IWB-2430, IWC-2430 and IWD-2430, respectively, for Class 1, 2, and 3 components. The project team noted that GALL Report, Appendix XI.S3, "Monitoring and Trending," states that for piping and component supports within the scope of ASME Section XI, Subsection IWF, there is no requirement to monitor or report progressive, time-dependent degradation and that unacceptable conditions, according to IWF-3400, are noted for correction or further evaluation.

The project team noted that the "Monitoring and Trending" program element for the plant-specific ISI program in the PNPS LRA provided only a very broad description of a monitoring and trending process, with no explicit reference to ASME Section XI requirements, and that the description did not appear to conform with the level of detail described for this program element in Appendix A.1.2.3.5 of the SRP-LR. The project team asked the applicant to provide a description of the parameter(s) or indicator(s) being trended and of the methodology for analyzing the inspection or test results. In its letter dated **mm-dd-yyyy(MLxxxxxxxxxx)** the applicant amended the "Monitoring and Trending" program element in LRA Section B.1.16.2 to include the following information: **{OPEN ITEM}**

> The parameter(s) or indicator(s) being trended and the methodology for analyzing the inspection or test results are in accordance with the requirements of ASME Section XI. As described in LRA Section B.1.16.2, the Inservice Inspection Program uses nondestructive examination (NDE) techniques to detect and characterize surface and subsurface flaws. Therefore, the parameter being trended is the presence of a flaw indication.
>
> Results are compared, as appropriate, to baseline date and other previous test results. Indications are evaluated in accordance with ASME Section XI. If the component is qualified as acceptable for continued service, the area containing the indication is reexamined during subsequent inspection periods. Examinations that reveal indications that exceed the acceptance standards are extended to include additional examinations in accordance with ASME Section XI.

The project team determined that the "Monitoring and Trending" program element, as amended, includes sufficient additional details and appropriate references to ASME Section XI to conform with the requirements for this program element as described in Appendix A.1.2.3.5 of the SRP-LR. The project team also determined that, as amended, the description of this program element for the PNPS site-specific ISI Program, is consistent with the GALL Report's descriptions of the program element. On the basis that the "Monitoring and Trending" program element in the applicant's plant-specific ISI Program is consistent with the "Monitoring and Trending" program element as described in the GALL Report for programs encompassed by the applicant's program, the project team found this element of the applicant's plant-specific program to be acceptable

The project team determined that the "Monitoring and Trending" program element satisfies the criteria defined in Appendix A.1.2.3.5 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Monitoring and Trending" program element is acceptable.

3.0.3.3.3.1.6 <u>Acceptance Criteria</u>

The "Acceptance Criteria" program element in Appendix A.1.2.3.6 of the SRP-LR can be summarized as:

> The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.
>
> The program should include a methodology for analyzing the results against applicable acceptance criteria.
>
> Qualitative 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 stated in PNPS AMP B.1.16.2, for the "Acceptance Criteria" program element, that a preservice, or baseline, inspection of program components was performed prior to startup to assure freedom from defects greater than code-allowable. The applicant stated that these baseline data also provide a basis for evaluating subsequent inservice inspection results. The applicant stated that since plant startup, additional inspection criteria for Class 2 and 3 components have been imposed by 10 CFR 50.55a for which baseline and inservice data has also been obtained and that results of inservice inspections are compared, as appropriate, to baseline data, other previous test results, and acceptance criteria of the ASME Section XI, 1998 Edition, 2000 Addenda, for evaluation of any evidence of degradation.

During the audit and review, the project team noted the applicant's statement that PNPS's plant-specific ISI program encompasses the requirements of ASME Section XI, Subsections IWB, IWC, IWD, and IWF, which are described in the GALL Report; Appendix XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD;, and Appendix XI.S3, ASME Section XI, Subsection IWF, respectively. The project team reviewed the "Acceptance Criteria" program element as described in the GALL Report, Appendix XI.M1 and Appendix XI.S3, respectively. The project team noted that GALL Report, Appendix XI.M1, "Acceptance Criteria," describes the acceptance criteria for Class 1, 2, and 3 components by reference ASME Section XI, Article IWB-3000, IWC-3000, and IWD-3000, respectively, and applicable subsections contained therein; and that GALL Report, Appendix XI.S3, "Acceptance Criteria," describes the acceptance criteria for Class 1, 2, 3, and MC supports by reference to ASME Section XI, Article IWF-3400, and applicable subsections contained therein. The project team determined that for the PNPS site-specific ISI Program, the applicant's "Acceptance Criteria" program element is described broadly in terms of baseline and subsequent inspections, with reference to acceptance criteria of the ASME Section XI, 1998 edition with 2000 addenda. On the basis that the "Acceptance Criteria" program element in the applicant's plant-specific ISI Program is referenced to the acceptance criteria of an approved ASME Section XI code edition, the project team found this element of the applicant's plant-specific program to be acceptable.

The project team determined that the "Acceptance Criteria" program element satisfies the criteria defined in Appendix A.1.2.3.6 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Acceptance Criteria" program element is acceptable.

3.0.3.3.3.1.7 Corrective Actions

The "corrective actions" program element in Appendix A.1.2.3.7 of the SRP-LR can be summarized as:

> Actions to be taken when the acceptance criteria are not met should be described. Corrective actions, including root cause determination and prevention of recurrence, should be timely.
>
> If corrective actions permit analysis without repair or replacement, the analysis should ensure that the structure and component intended function(s) will be maintained consistent with the CLB.

During the audit and review, the project team noted the applicant's statement that PNPS's plant-specific ISI program encompasses the requirements of ASME Section XI, Subsections IWB, IWC, IWD, and IWF, which are described in the GALL Report; Appendix XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD; and Appendix XI.S3, ASME Section XI, Subsection IWF, respectively. The project team reviewed the "Corrective Actions" program element as described in the GALL Report, Appendix XI.M1 and Appendix XI.S3, respectively. The project team noted that GALL Report, Appendix XI.M1, "Corrective Actions" describes repair criteria for Class 1, 2, and 3 components by reference ASME Section XI, Article IWB-4000, IWC-4000 and IWD-4000, and replacement criteria by reference to ASME Section XI, Article IWB-7000, IWC-7000 and IWD-7000. The project team also noted that GALL Report, Appendix XI.S3, "Corrective Actions" describes the corrective actions for Class 1, 2, 3, and MC supports by reference to ASME Section XI, Subsection IWF-3122. In addition, the project team noted that the references to IWB-4000, IWC-4000, and IWD-4000, and to IWB-7000, IWC-7000, and IWD-7000 are out of date and that requirements for repair and replacement of Class 1, 2 and 3 components are specified in Article IWA-4000 of ASME Section XI, the 2001 edition, on which the current revision of the GALL Report is based. The project team determined that the PNPS site-specific ISI program refers to evaluation in accordance with ASME Section XI, Articles IWA-3000, IWB-3000, IWC-3000, IWD-3000, and IWF-3000, and that it refers to repair and replacement of Class 1, 2 and 3 components in conformance with ASME Section XI, Article IWA-4000. On the basis that the "Corrective Actions" program element in the applicant's plant-specific ISI Program is referenced to the appropriate articles of ASME Section XI, the project team found this element of the applicant's plant-specific program to be acceptable

The project team determined that the "Corrective Actions" program element satisfies the criteria defined in Appendix A.1.2.3.7 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Corrective Actions" program element is acceptable.

3.0.3.3.3.1.8 Confirmation Process

**{WRJ Note: A generic write-up for this section is needed, since all audit team members are looking at the same statement referring to LRA Section B.0.3.}**

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.8 of the SRP-LR. [Project team's evaluation]. On this basis, the project team found that the applicant's description of the "Confirmation Process" program element is acceptable.

3.0.3.3.3.1.9 Administrative Controls

**{WRJ Note: A generic write-up for this section is needed, since all audit team members are looking at the same statement referring to LRA Section B.0.3.}**

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.9 of the SRP-LR. [Project team's evaluation]. On this basis, the project team found that the applicant's description of the "Administrative Controls" program element is acceptable.

3.0.3.3.3.1.10 Operating Experience

The "Operating Experience" program element criteria in Appendix A.1.2.3.10 of the SRP-LR can be summarized as:

> 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.
>
> An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The applicant stated, in the PNPS LRA, for the "Operating Experience" program element, that intergranular stress corrosion cracking was discovered during RFO06 in the thermal sleeve at 9 of the 10 recirculation supply nozzles. GE has performed an evaluation to demonstrate no further crack growth with hydrogen water chemistry protection.

A scheduled ISI surface examination in 1997 detected an indication adjacent to a welded pipe support lug. The lug was removed and the indication was repaired by welding. A scheduled ISI visual examination in 1999 detected a snubber with restricted movement and cold piston setting out of tolerance. The restriction was reworked and the cold piston setting was accepted by evaluation. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

One hundred and forty-two scheduled ISI (ASME Section XI Subsections IWB, IWC, IWD, and IWF) examinations were performed online (between RFO13 and RFO14) and during RFO14 (April 2003). Results show that one spring hanger support in the residual heat-removal system required rework because ISI visual inspection determined that bolting was loose. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

One hundred and ninety-four scheduled ISI (ASME Section XI Subsections IWB, IWC, IWD, and IWF) examinations were performed online (between RFO14 and RFO15) and during RFO15 (April 2005). Results show that cracked welds on four steam dryer tie-bars were repaired, loose bolting on a hanger was reworked, a UT exam indication on a standby liquid control system weld was repaired, and a number of RPV safe-end welds were accepted by evaluation because they had wall thickness less than the screening criteria, but not less than design minimums. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

A QA audit and an NRC inspection in spring 2005 revealed no issues or findings that could impact effectiveness of the program.



The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the plant-specific Inservice Inspection Program and did not find any evidence of PNPS component degradation or failures that are outside the envelope of 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 concluded that the applicant's Inservice Inspection Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

Based on its review of operating experience described for the applicant's plant-specific ISI Program, the project team determined that the "Operating Experience" program element satisfies the criteria defined in Appendix A.1.2.3.10 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Operating Experience" program element is acceptable.

3.0.3.3.3.2 UFSAR Supplement

The applicant provided its UFSAR Supplements for the Inservice Inspection Program in the PNPS LRA, Appendix A, Section A.2.1.18, which states that the Inservice Inspection Program is based on ASME Inspection Program B (Section XI, IWA-2432), which has 10-year inspection intervals. Every 10 years, the program is updated to the latest ASME Section XI code edition and addendum approved in 10 CFR 50.55a. On July 1, 2005, PNPS entered the fourth ISI interval. The code edition and addenda used for the fourth interval is the 1998 Edition with 2000 Addenda.

The program consists of periodic volumetric, surface, and visual examination of components and their supports for assessment, signs of degradation, flaw evaluation, and corrective actions.

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).

3.0.3.3.3.3 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).



3.0.3.3.4 INSTRUMENT AIR QUALITY PROGRAM (PNPS AMP B.1.17)

In the PNPS LRA, Appendix B, Section B.1.17, the applicant described PNPS AMP B.1.17, "Instrument Air Quality Program."

The applicant stated that PNPS AMP B.1.17 is an existing plant-specific program. The Instrument Air Quality Program is a plant-specific program which ensures that instrument air supplied to components is maintained free of water and significant contaminants, thereby preserving an environment that is not conducive to loss of material. Dewpoint, particulate contamination, and hydrocarbon concentration are periodically checked to verify the instrument air quality is maintained.

The project team reviewed, in whole or part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.17 including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.15, "Instrument Air Quality Program," which provides an assessment of the AMP elements, and interviewed the applicant's technical staff.

3.0.3.3.4.1 Review of the PNPS AMP B.1.17 Against the Program Elements

The project team reviewed PNPS AMP B.1.17 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 review process as described in the PNPS audit and review plan.

3.0.3.3.4.1.1 Scope of Program

The "Scope of Program" program element 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.

The applicant stated in PNPS AMP B.1.17, for the "Scope of Program" program element, that this program applies to components within the scope of license renewal and subject to aging management review that are supplied with instrument air, for which pressure boundary integrity is required for the component to perform its intended function. During the audit and review, the project team requested that the applicant provide the specific components that subject to the Instrument Air Quality Program. In its response, the applicant stated that tubing and valve bodies are managed in the standby gas treatment system and piping, tanks, tubing, and valve bodies are managed in the instrument air system. The project team determined that the applicant's response to this request was acceptable because specific components were identified.

The applicant stated that the Instrument Air Quality Program will be enhanced to include a sample point in the standby gas treatment and torus vacuum breaker instrument air subsystem in addition to the instrument air header sample points. The applicant stated, in the PNPS LRA, that this enhancement will be initiated prior to the period of extended operation. The implementation of this enhancement by the applicant will verify that the environment of the standby gas treatment and torus vacuum breaker instrument air subsystem will not be conducive to loss of material thus providing additional assurance that loss of material will be adequately managed.



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

3.0.3.3.4.1.2 <u>Preventive Actions</u>

The "Preventive Actions" program element in Appendix A.1.2.3.2 of the SRP-LR are that (1) the activities for prevention and mitigation programs should be described, and (2) for condition or performance monitoring programs that do not rely on preventive actions, and thus, preventive actions need not be provided.

The applicant stated in PNPS AMP B.1.17, for the "Preventive Actions" program element, that system air quality is monitored and maintained within specified limits to ensure that instrument air supplied to components is maintained free of water and significant contaminants, thereby preventing loss of material.

The project team determined that the "Preventive Actions" program element satisfies the criteria defined in Appendix A.1.2.3.2 of the SRP-LR. Air quality is maintained within specified limits for water content and contamination to prevent loss of material. Dewpoint, particulate contamination, and hydrocarbon concentration are periodically checked at least every 18 months to verify instrument air quality is maintained as indicated in B.1.17/AMPER 4.15: Instrument Air Quality Program, Evaluation of Aging Management Programs, LRPD-02, Revision 1, Section

4.15, pages 173 of 286 through 175 of 286, Pilgrim Nuclear Power Station License Renewal Project. Parameters to be monitored that are linked to specific degradation are identified. Parameters monitored/inspected in this program are consistent with SRP-LR. On this basis, the project team found that the applicant's "Preventive Actions" is acceptable.

3.0.3.3.4.1.3 <u>Parameters Monitored/Inspected</u>

The "Parameters Monitored/Inspected" program element in Appendix A.1.2.3.3 of the SRP-LR can be summarized as:

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

The applicant stated in PNPS AMP B.1.17, for the "Parameters Monitored/Inspected" program element, that dewpoint, particulate contamination, and hydrocarbon concentration (oil mist) are periodically checked to verify instrument air quality is maintained.

The project team determined that the "Parameters Monitored/Inspected" program element satisfies the criteria defined in Appendix A.1.2.3.3 of the SRP-LR. Dewpoint, particulate contamination and hydrocarbon concentration are periodically checked at least every 18 months to verify instrument air quality is maintained as indicated in B.1.17/AMPER 4.15: Instrument Air Quality Program, Evaluation of Aging Management Programs, LRPD-02, Revision 1, Section 4.15, pages 173 of 286 through 175 of 286, Pilgrim Nuclear Power Station License Renewal Project. Parameters to be monitored that are linked to specific degradation are identified. Parameters monitored/inspected in this program are consistent with SRP-LR. On this basis, the project team found that the applicant's description of the "Parameters Monitored/Inspected" is acceptable.

3.0.3.3.4.1.4 <u>Detection of Aging Effects</u>

The "Detection of Aging Effects" program element in Appendix A.1.2.3.4 of the SRP-LR can be summarized as:

> Provide information that links the parameters to be monitored or inspected to the aging effects being managed.

Describe when, where, and how program data are collected (i.e., all aspects of activities to collect data as part of the program).

Link the method or technique and frequency, if applicable, to plant-specific or industry-wide operating experience.

Provide the basis for the inspection population and sample size when sampling is used to inspect a group of SCs. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.

The applicant stated in PNPS AMP B.1.17 for the "Detection of Aging Effects" program element that dewpoint, particulate contamination, and hydrocarbon concentration are periodically checked to verify instrument air quality is maintained, thereby preventing loss of material. At least once per 18 months, dew point, particulate contamination, and hydrocarbon concentration are monitored at several locations in the instrument air system.

The project team determined that this program element satisfies the criteria defined in Appendix A.1.2.3.4 of the SRP-LR. Dewpoint, particulate contamination, and hydrocarbon concentration are periodically checked to verify instrument air quality is maintained, thereby preventing loss of material. At least once per 18 months, dew point particulate contamination and hydrocarbon concentration are monitored at several locations in the instrument air system. Inspection sample and frequency will ensure the that effects of aging are identified before the loss of intended function as indicated in B.1.17/AMPER 4.15: Instrument Air Quality Program, Evaluation of Aging Management Programs, LRPD-02, Revision 1, Section 4.15, pages 173 of 286 through 175 of 286, Pilgrim Nuclear Power Station License Renewal Project. On this basis, the project team found that the applicant's description of the "Detection of Aging Effects" is acceptable.

3.0.3.3.4.1.5 Monitoring and Trending

The "Monitoring and Trending" program element in Appendix A.1.2.3.5 of the SRP-LR can be summarized as:

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 are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The applicant stated in PNPS AMP B.1.17, for the "Monitoring and Trending" program element, that results of sample analyses are maintained in the chemistry log. A condition report is issued if data indicate deteriorating instrument air quality. During the audit and review, the project team requested the applicant to provide details describing the methods that determine deteriorating air quality. The applicant provided to the project team PNPS procedure 7.1.69, System Air Quality Sampling, during the site audit for reviewed. This procedure provides for trending of instrument air quality. On this basis, the project team found that the applicant's description of the "Monitoring and Trending" is acceptable.

3.0.3.3.4.1.6 <u>Acceptance Criteria</u>

The "Acceptance Criteria" program element in Appendix A.1.2.3.6 of the SRP-LR can be summarized as:

> The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.
>
> The program should include a methodology for analyzing the results against applicable acceptance criteria.
>
> Qualitative 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 stated in PNPS AMP B.1.17, for the "Acceptance Criteria" program element, that the dew point is less than or equal to 20°F and oil mist and particulate are less than 1.2 mg/m³.

The project team evaluated this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.6 of the SRP-LR. The PNPS Instrument Air Quality Program acceptance criteria are dew point ≤-20°F and oil mist and particulate < 1.2 mg/m³; therefore, numerical values of acceptance criteria are provided by this program. The LRA did not provide the basis of the acceptance criteria and therefore, during the audit and review, the project team requested the applicant to provide this basis. In its response, the applicant stated that the basis of the acceptance criteria are ANSI/ISA 7.3, which are cited in procedure 7.1.69, System Air Quality Sampling. On this basis, the project team found that the applicant's description of the "Acceptance Criteria" is acceptable.

3.0.3.3.4.1.7 <u>Corrective Actions</u>

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.7 of the SRP-LR. This program will be administered under the site QA program which meets requirements of 10 CFR Part 50, Appendix B. On this basis, the project team found that the applicant's description of the "Corrective Actions" is acceptable.

3.0.3.3.4.1.8 <u>Confirmation Process</u>

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.8 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Confirmation Process" is acceptable.

3.0.3.3.4.1.9 <u>Administrative Controls</u>

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.9 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Administrative Controls" is acceptable.

3.0.3.3.4.1.10 <u>Operating Experience</u>

The "Operating Experience" program element criteria in Appendix A.1.2.3.10 of the SRP-LR can be summarized as:



> 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.
>
> An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The applicant stated, in the PNPS LRA, for the "Operating Experience" program element, that in 1999, an instrument air dryer dewpoint reading was greater than the acceptance criterion of less than or equal to -20°F. A faulty solenoid valve was replaced and dewpoint was confirmed to be less than or equal to -20°F. Monitoring of instrument air quality and subsequent corrective actions provide evidence that the program is effective in managing loss of material and cracking of instrument air system components.

For a period of time (October 2001 through March 2005), dew point, particulate contamination, and hydrocarbon concentration (oil mist) were not sampled in the instrument air system. Procedures were corrected in March 2005 to require dew point, particulate contamination, and hydrocarbon concentration (oil mist) sampling at several locations in the instrument air system. Sample results for the service air system, which supplies the instrument air system, show that dewpoint, oil mist and particulates were within acceptance criteria. Instrument air header moisture checks during the same period found little or no moisture. Therefore, instrument air quality is assumed to have been maintained and will be maintained from now on by sampling in accordance with the Instrument Air Quality Program. Continuous confirmation of instrument air quality and subsequent corrective actions provide evidence that the program is effective in managing loss of material and cracking of instrument air system components.

The PNPS Instrument Air Quality Program operating experience includes corrective actions that respond to degradation and enhancements to the program to assure timely monitoring of instrument air contamination and moisture content. New sampling points were added to procedures as a result of operating experience. The Instrument Air Quality Program will be enhanced to include a sample point in the standby gas treatment and torus vacuum breaker instrument air subsystem in addition to the instrument air header sample points. This enhancement is item #13 on the applicant's list of commitments for license renewal and will be completed prior to the period of extended operation.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS License Renewal Project Operating Experience Review Report, LRPD-05, Section 4.15: Instrument Air Quality Program and did not find any evidence of PNPS component degradation or failures that are outside the envelope of 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 concluded that the applicant's Instrument Air Quality Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.3.4.2 UFSAR Supplement

The applicant provided its UFSAR Supplements for the Instrument Air Quality Program in the PNPS LRA, Appendix A, Section A.2.1.19, which states that the Instrument Air Quality Program ensures that instrument air supplied to components is maintained free of water and significant contaminants, thereby preserving an environment that is not conducive to loss of material. Dewpoint, particulate contamination, and hydrocarbon concentration are periodically checked to verify the instrument air quality is maintained.

During the audit and review, the project team noted that the applicant's description of the B.1.17 program in UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the enhancements described in LRA, Appendix B.1.17. The project team asked the applicant to include a description of the enhancements to PNPS' B.1.17 program in the UFSAR Supplement in LRA, Appendix A as recommended by NUREG-1800, Section 3.X.2.4. In response to this request, the applicant stated that program description in Appendix A will be revised to identify the commitment number(s) associated with the enhancement(s) for that program as described in LRA Appendix B. The program description in Appendix A will be amended to include the following statement:

> License renewal commitment number X specifies enhancement to this program.

This will require an amendment to the license renewal application. (**Open item**).

When PNPS officially issues the commitment list and the revised write-up, the appropriate commitment number should be inserted above.

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).

3.0.3.3.4.3 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.5 PERIODIC SURVEILLANCE AND PREVENTIVE MAINTENANCE PROGRAM (PNPS AMP B.1.24)



In the PNPS LRA, Appendix B, Section B.1.24, the applicant described PNPS AMP B.1.24, "Periodic Surveillance and Preventive Maintenance Program."

The applicant stated that PNPS AMP B.1.24 is an existing plant-specific program. The Periodic Surveillance and Preventive Maintenance Program includes periodic inspections and tests that manage aging effects not managed by other aging management programs. The preventive maintenance and surveillance testing activities are generally implemented through repetitive tasks or routine monitoring of plant operations. Credit for program activities has been taken in the aging management review of the following systems and structures.

| | |
|---|---|
| reactor building | Perform visual or other non-destructive examination to manage loss of material for the reactor building crane, rails, and girders and refueling platform carbon steel components. |
| process facilities | Visually inspect the main stack components to manage loss of material for carbon steel and cracking, spalling, or loss of material for concrete. |
| standby liquid control | Use UT or other NDE techniques to verify system remaining wall thickness to manage loss of material from internal surfaces of the carbon steel discharge accumulators. |

automatic depressurization Use visual or other NDE techniques to inspect system torus to manage loss of material for carbon steel piping in the waterline region of the torus.

high-pressure coolant Use visual or other NDE techniques to inspect a representative sample of the internals of gland seal condenser blower (P-223) and suction piping to manage loss of material.

reactor core isolation Use visual or other NDE techniques to inspect cooling system a representative sample of RCIC steam supply and exhaust piping downstream of the strainers and steam traps to manage loss of material.

standby gas treatment Perform a visual inspection of accessible system expansion joints for cracks. Also perform manual flexing (manipulation) of the expansion joints to determine if they have become brittle. These inspections will verify the absence of significant change in material properties.

Use visual or other NDE techniques to inspect internal surfaces of the valve bodies and piping in the demister drains to manage loss of material.



Use visual or other NDE techniques to inspect a representative sample of the internal and external surfaces of the drain lines from each reactor building auxiliary bay passing into the water trough in the torus room to manage loss of material.

reactor building closed Use visual or other NDE techniques to inspect cooling water system clean-up recirc pump P-204B stuffing box cooler to manage loss of material due to wear.

Use visual or other NDE techniques to inspect a representative sample of the in-scope RBCCW copper alloy cooling coils to manage loss of material.

emergency diesel generator Use visual or other NDE techniques to inspect system a representative sample of EDG intake air, air start, and exhaust components to manage loss of material and fouling.

Visually inspect A/B EDG jacket water radiators to manage loss of material and fouling. fouling for heat exchanger tubes.

station blackout diesel Use visual or other NDE techniques to inspect generator system a representative sample of station blackout diesel intake air, air start, and exhaust components to manage loss of material, cracking, and fouling.

Visually inspect station blackout jacket water radiator to manage loss of material and fouling.

Perform station blackout diesel surveillance test to manage fouling for heat exchanger tubes.

| | |
|---|---|
| heating, ventilation, and air | Use visual or other NDE techniques to inspect conditioning system the air side of the copper alloy tubes of heat exchangers VAC 201A/B, VAC-202A/B, and VAC- 204A/B/C/D to manage loss of material and fouling. |

Visually inspect and manually flex VSF-103A/B, VAC-202A/B, VAC-204A/B/C/D, and EDG engine-driven fan duct flexible connections to manage cracking and change in material properties.

| | |
|---|---|
| security diesel | Perform security diesel generator surveillance test (loaded) to manage fouling for heat exchanger tubes. |

Use visual or other NDE techniques to inspect a representative sample of security diesel oil cooler, aftercooler, and radiator tubes to manage loss of material.

Use visual or other NDE techniques to inspect a representative sample of security diesel intake air and exhaust components to manage cracking and loss of material on internal surfaces.

| | |
|---|---|
| condensate storage system | Use visual or other NDE techniques to inspect a representative sample of the internal and external surfaces of the condensate storage tanks to manage loss of material. |
| nonsafety-related systems | Use visual or other NDE techniques to inspect affecting safety-related representative water, potable & sanitary water, systems radioactive waste, sanitary soiled waste & vent, plumbing and drains and screen wash system components to manage internal loss of material. |

Visually inspect and manually flex a representative sample of the flex/expansion joints in the circulating water, HVAC/chilled water, and radioactive waste systems to manage cracking and change in material properties.

The project team reviewed, in whole or part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.24 including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.17, "Periodic Surveillance and Preventive Maintenance Program," and interviewed the applicant's technical staff.

3.0.3.3.5.1 Review of the PNPS AMP B.1.24 Against the Program Elements

The project team reviewed PNPS AMP B.1.24 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 review process as described in the PNPS audit and review plan.

3.0.3.3.5.1.1 Scope of Program

The "Scope of Program" program element 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.

The applicant stated in PNPS AMP B.1.24, for the "Scope of Program" program element, that this program, with regard to license renewal, includes those tasks credited with managing aging effects identified in aging management reviews.

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

3.0.3.3.5.1.2 <u>Preventive Actions</u>

The "Preventive Actions" program element in Appendix A.1.2.3.2 of the SRP-LR are that (1) the activities for prevention and mitigation programs should be described, and (2) for condition or performance monitoring programs that do not rely on preventive actions, and thus, preventive actions need not be provided.

The applicant stated in PNPS AMP B.1.24, for the "Preventive Actions" program element, that inspection and testing activities used to identify component aging effects do not prevent aging effects. However, activities are intended to prevent failures of components that might be caused by aging effects.



The project team determined that the "Preventive Actions" program element satisfies the criteria defined in Appendix A.1.2.3.2 of the SRP-LR. Visual or other NDE techniques are used to identify component aging primarily fouling and loss of material to prevent failures of structures, systems, and components within the scope of the PNPS Periodic Surveillance and Preventive Maintenance Program. Preventive actions of this program are consistent with SRP-LR. On this basis, the project team found that the applicant's "Preventive Actions" acceptable.

3.0.3.3.5.1.3 <u>Parameters Monitored/Inspected</u>

The "Parameters Monitored/Inspected" program element in Appendix A.1.2.3.3 of the SRP-LR can be summarized as:

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

For prevention and mitigation programs, the parameter monitored should be the specific parameter being controlled to achieve prevention or mitigation of aging effects.

The applicant stated in PNPS AMP B.1.24, for the "Parameters Monitored/Inspected" program element, that this program provides instructions for monitoring structures, systems, and components to detect degradation. Inspection and testing activities monitor various parameters including system flow, system pressure, surface condition, loss of material, presence of corrosion products, and signs of cracking.

The project team determined that the "Parameters Monitored/Inspected" program element satisfies the criteria defined in Appendix A.1.2.3.3 of the SRP-LR. This program provides instructions for monitoring structures, systems, and components to detect degradation. Inspection and testing activities monitor various parameters including system flow, system pressure, surface condition, loss of material, presence of corrosion products, and signs of cracking. Parameters to be monitored are linked to specific degradation are identified. Parameters monitored/inspected in this program are consistent with SRP-LR. On this basis, the project team found that the applicant's description of the "Parameters Monitored/Inspected" is acceptable.

3.0.3.3.5.1.4 Detection of Aging Effects

The "Detection of Aging Effects" program element in Appendix A.1.2.3.4 of the SRP-LR can be summarized as:

Provide information that links the parameters to be monitored or inspected to the aging effects being managed.

Describe when, where, and how program data are collected (i.e., all aspects of activities to collect data as part of the program).

Link the method or technique and frequency, if applicable, to plant-specific or industry-wide operating experience.

Provide the basis for the inspection population and sample size when sampling is used to inspect a group of SCs. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.

The applicant stated in PNPS AMP B.1.24 for the "Detection of Aging Effects" program element that preventive maintenance activities and periodic surveillances provide for periodic component inspections and testing to detect aging effects. Inspection intervals are established such that they provide timely detection of degradation. Inspection intervals are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations. Each inspection or test occurs at least once every 10 years.

The extent and schedule of inspections and testing assure detection of component degradation prior to loss of intended functions. Established techniques such as visual inspections are used.

The project team determined that this program element satisfies the criteria defined in Appendix A.1.2.3.4 of the SRP-LR. Preventive maintenance activities and periodic surveillances provide for periodic component inspections and testing to detect aging effects. Inspection intervals are established such that they provide timely detection of degradation. Inspection intervals are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturer recommendations. Each inspection or test occurs at least once every 10 years and, in most cases, every 5 years. The project team reviewed the operating experience and concluded that there was no significant deterioration observed which justifies the inspection intervals found in Aging Management Program Evaluation Report, LRPD-02, Revision 1, Attachment 3, "Periodic Surveillance and Preventative Maintenance Activities." This table provides the procedure and/or PM activity that specifies the parameters to be inspected, the inspection interval, and the acceptance criterion of degradation (such as loss of material, cracking, and fouling) for each component covered by the PNPS Periodic Surveillance and Preventive Maintenance Program. Detection of aging effects is sufficient to preclude loss of structure and component intended function.

The project team noted in Aging Management Program Evaluation Report, LRPD-02, Revision 1, Attachment 3, "Periodic Surveillance and Preventative Maintenance Activities," that enhancements to existing procedures or development of new procedures will be necessary to implement the inspections of this program. Therefore, the applicant committed to an enhancement to the Periodic Surveillance and Preventative Maintenance Program in the LRA.

Prior to the period of extended operation, program activity implementing documents will be enhanced as necessary to assure that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

The project team noted that the details for the enhancements to existing procedures or development of new procedures are contained in Aging Management Program Evaluation Report, LRPD-02, Revision 1, Attachment 3, "Periodic Surveillance and Preventative Maintenance Activities."

The PNPS Periodic Surveillance and Preventive Maintenance Program describes when, where, and how program data are collected and provides justification that technique and frequency are adequate to detect aging effects before loss of SC intended function. However, the project team noticed that there were no code or standards cited in the program. As a result, the project team asked the applicant to provide any codes and standards used for detection of aging effects. In its response, the applicant stated that many of the maintenance activities include visual or other non-destructive examinations of structures, systems, and components. These examinations are performed in accordance with approved procedures that are consistent with ASME Section XI and 10 CFR50 Appendix B. The project team determined that the applicant's response to this request was acceptable because appropriate codes are identified in accordance with the SRP-LR.

This element of the PNPS Periodic Surveillance and Preventive Maintenance Programis consistent with SRP-LR. On this basis, the project team found that the applicant's description of the "Detection of Aging Effects" is acceptable.

3.0.3.3.5.1.5 <u>Monitoring and Trending</u>

The "Monitoring and Trending" program element in Appendix A.1.2.3.5 of the SRP-LR can be summarized as:

> 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 are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The applicant stated in PNPS AMP B.1.24, for the "Monitoring and Trending" program element, that preventive maintenance and surveillance testing activities provide for monitoring and trending of aging degradation. Inspection and testing intervals are established such that they provide for timely detection of component degradation. Inspection and testing intervals are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

The project team determined that for visual inspection, this program element satisfies the criteria defined in Appendix A.1.2.3.5 of the SRP-LR. Although the PNPS Periodic Surveillance and Preventive Maintenance Program states the above attributes for monitoring and trending, the project team determined that the LRA was not detailed enough to make an assessment of this element of the program. As a result, the project team requested the applicant to provide trending methods used in this program. In its response, the applicant stated that inspection and testing intervals are established such that they provide for timely detection of structures, systems, and components degradation. Inspection and testing intervals are dependent on the material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations. Trending of degraded components occurs within the Corrective Action Program. The project team determined that the applicant's response to this request was acceptable because this approach of establishing degradation trends was adequate to detect aging effects in structure, systems, or components before loss of intended function.

On this basis, the project team found that the applicant's description of the "Monitoring and Trending" is acceptable.

3.0.3.3.5.1.6 <u>Acceptance Criteria</u>

The "Acceptance Criteria" program element in Appendix A.1.2.3.6 of the SRP-LR can be summarized as:

> The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that

the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.

The program should include a methodology for analyzing the results against applicable acceptance criteria.

Qualitative 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 stated in PNPS AMP B.1.24, for the "Acceptance Criteria" program element, that the Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in specific inspection and testing procedures. The procedures confirm component integrity by verifying the absence of aging effects or by comparing applicable parameters to limits based on applicable intended functions established by plant design basis.

The project team determined this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.6 of the SRP-LR. The project team determined that the PNPS Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in specific inspection and testing procedures. This element of the PNPS Periodic Surveillance and Preventive Maintenance Program is consistent with this item of the SRP-LR. On this basis, the project team found that the applicant's description of the "Acceptance Criteria" is acceptable.



3.0.3.3.5.1.7 Corrective Actions

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.7 of the SRP-LR. The PNPS Corrective Action Program, quality assurance procedures, site review and approval process, and administrative controls are implemented in accordance with requirements of 10 CFR 50, Appendix B. On this basis, the project team found that the applicant's description of the "Corrective Actions" is acceptable.

3.0.3.3.5.1.8 Confirmation Process

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.
The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.8 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Confirmation Process" is acceptable.

3.0.3.3.5.1.9 Administrative Controls

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element is reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.9 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Administrative Controls" is acceptable.

3.0.3.3.5.1.10 Operating Experience

The "Operating Experience" program element criteria in Appendix A.1.2.3.10 of the SRP-LR can be summarized as:

> 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.
>
> An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The applicant stated, in the PNPS LRA, for the "Operating Experience" program element, that inspection of the reactor building crane in 2000 and of the refueling platform in March 2003 found no significant corrosion or wear. Absence of significant corrosion and wear provides evidence that the program is effective for managing loss of material for the reactor building crane, rails, and girders and refueling platform carbon steel components.

Visual inspection of the main stack and guy wires in June 2004 revealed no significant corrosion of steel structures and components. Similarly, inspection of the concrete anchor blocks revealed no cracking, spalling, or other loss of material. Absence of steel corrosion and concrete cracking, spalling, and loss of material provides evidence that the program is effective for managing aging effects for components of the main stack.

In 1999, visual inspection of the drywell spray header revealed no significant corrosion. Absence of significant corrosion provides evidence that the program is effective for managing loss of material for the drywell spray header.

In 1999, the below-water regions of all 16 torus bays as well as the drywell to torus vent areas with water accumulation were inspected. The condition of other submerged structures and components was also reported. Results revealed no significant corrosion on submerged structures and components within the torus. Absence of significant corrosion provides evidence that the program is effective for managing loss of material for carbon steel SRV tailpipes in the waterline region of the torus.

During visual inspection of standby gas treatment system exhaust fans in 2000 and 2001, the expansion joints which connect the fans to ductwork were disconnected from the fans to facilitate fan inspection. Inspection of the expansion joints after this evolution revealed no cracking. Absence of cracking provides evidence that the program is effective for managing cracking and change in material properties for the expansion joints.

No significant corrosion or wear was found on the reactor recirculation system MG sets area cooling coils during an inspection in 2000. Absence of significant corrosion or wear provides evidence that the program is effective for managing loss of material for RBCCW copper alloy cooling coils.

During a 2002 run of the A EDG, soot buildup was noticed on the turbo charger. Although no obvious leakage was noted, soot buildup may indicate existence of a small exhaust leak. Thermography was performed during the next diesel run to determine if and where leakage was occurring, but no leakage was found. Identification of possible degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing loss of material for EDG exhaust components.

Inspections of EDG air intake and jacket water radiator components in 1999 and 2004 revealed no significant corrosion, wear, or fouling. Also, no significant corrosion was found on air start components or exhaust components during the inspections. Absence of aging effects provides evidence that the program is effective for managing aging effects for EDG components.

The project team reviewed the operating experience provided in the PNPS 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 addition, the project team reviewed PNPS operating experience as documented in the PNPS Operating Experience Review Report for the Periodic Surveillance and Preventive Maintenance Program and did not find any evidence of PNPS component degradation or failures that are outside the envelope of 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 concluded that the applicant's Periodic Surveillance and Preventive Maintenance Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.3.5.2 UFSAR Supplement

The applicant provided its UFSAR Supplements for the Periodic Surveillance and Preventive Maintenance Program in the PNPS LRA, Appendix A, Section A.2.1.26, which states that the Periodic Surveillance and Preventive Maintenance Program includes periodic inspections and tests that manage aging effects not managed by other aging management programs. The preventive maintenance and surveillance testing activities are generally implemented through repetitive tasks or routine monitoring of plant operations.

Temperatures are monitored during periodic emergency diesel generator (EDG), station blackout diesel, and security diesel surveillance tests to verify that associated heat exchangers are capable of removing the required amount of heat, thereby managing fouling of the heat exchanger tubes.

Periodic inspections using visual or other non-destructive examination techniques verify that the following components are capable of performing their intended function.

- Reactor building crane, rails, and girders.
- Refueling platform carbon steel components.
- Main stack components.
- Standby liquid control system discharge accumulators.
- Carbon steel piping in the waterline region of the torus.
- HPCI gland seal condenser blower and suction piping.
- RCIC steam supply and exhaust piping downstream of the strainers and steam traps.
- Standby gas treatment system expansion joints, demister drain valves, and demister drain piping.
- Drain lines from each reactor building auxiliary bay passing into the water trough in the torus.
- Clean-up recirculation pump P-204B stuffing box cooler.
- RBCCW copper alloy cooling coils.
- EDG, station blackout diesel, and security diesel intake air, air start, and exhaust components.
- EDG, station blackout diesel, and security diesel jacket water radiators.
- Security diesel oil cooler and aftercooler.
- Area coolers VAC-210A/B, VAC-202A/B, and VAC-204A/B/C/D.
- VSF-103A/B, VAC-202A/B, VAC-204A/B/C/D, and EDG engine driven fan duct flexible connections.
- Condensate storage tanks.
- Circulating water, potable & sanitary water, radioactive waste, sanitary soiled waste & vent, plumbing and drains, and screen wash system components.
- Flex/expansion joints in the circulating water, HVAC/chilled water, and radioactive waste systems.

During the audit and review, the project team noted that the applicant's description of the B.1.24 program in UFSAR Supplement in LRA, Appendix A, did not include, as a commitment, the enhancement described in LRA, Appendix B.1.24. The project team asked the applicant to include a description of the enhancement to PNPS' B.1.24 program in the UFSAR Supplement in LRA, Appendix A as recommended by NUREG-1800, section 3.X.2.4. In response to this request, the applicant stated that program description in Appendix A will be revised to identify the commitment number associated with the enhancement for that program as described in LRA Appendix B. The program description in Appendix A will be amended to include the following statement:

> License renewal commitment number X specifies an enhancement to this program.

This will require an amendment to the license renewal application. (Open item).

When PNPS officially issues the commitment list and the revised write-up, the appropriate commitment number should be inserted above.

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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).

3.0.3.3.5.3 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.6 WATER CHEMISTRY CONTROL – AUXILIARY SYSTEMS PROGRAM (PNPS AMP B.1.32.1)

In the PNPS LRA, Appendix B, Section B.1.32.1, the applicant described PNPS AMP B.1.32.1, "Water Chemistry Control – Auxiliary Systems Program."

The applicant stated that PNPS AMP B.1.32.1 is an existing plant-specific program. The purpose of the Water Chemistry Control – Auxiliary Systems Program is to manage loss of material for components exposed to treated water. Program activities include sampling and analysis of the stator cooling water system to minimize component exposure to aggressive environments.

The project team reviewed, in whole or part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.32.1 including Aging Management Program Evaluation Report, LRPD-02, Revision 1, Section 4.23.1, "Water Chemistry Control - Auxiliary System Program," and interviewed the applicant's technical staff.

3.0.3.3.6.1 Review of the PNPS AMP B.1.32.1 Against the Program Elements

The project team reviewed PNPS AMP B.1.32.1 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 review process as described in the PNPS audit and review plan.

3.0.3.3.6.1.1 Scope of Program

The "Scope of Program" program element 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.

The applicant stated in PNPS AMP B.1.32.1, for the "Scope of Program" program element, that program activities include sampling and analysis of the stator cooling water system to minimize component exposure to aggressive environments.

City water is taken from the Town of Plymouth water main and distributed throughout the potable and sanitary water system at town water pressure. City water is monitored and treated by the Town of Plymouth to meet the regulations of the Commonwealth of Massachusetts.

Since the applicant identified the stator cooling water system components to which this program is applied, the project team determined that the specific components for which the program manages aging effects are identified by the applicant, which satisfies the criterion as defined in Appendix A.1.2.3.1 of the SRP-LR. On this basis, the project team found that the applicant's proposed program scope is acceptable.

3.0.3.3.6.1.2 Preventive Actions

The "Preventive Actions" program element in Appendix A.1.2.3.2 of the SRP-LR are that (1) the activities for prevention and mitigation programs should be described, and (2) for condition or performance monitoring programs that do not rely on preventive actions, and thus, preventive actions need not be provided.

The applicant stated in PNPS AMP B.1.32.1, for the "Preventive Actions" program element, that the program includes monitoring and control of stator cooling water to minimize exposure to aggressive environments.



City water used in the potable and sanitary water system is monitored and treated by the town of Plymouth to meet the regulations of the Commonwealth of Massachusetts.

The project team determined that the "Preventive Actions" program element satisfies the criteria defined in Appendix A.1.2.3.2 of the SRP-LR. Because the applicant has identified the preventive action performed by the town of Plymouth to monitor the cooling water, on this basis the project team found that the applicant's description of "Preventive Actions" is acceptable.

3.0.3.3.6.1.3 Parameters Monitored/Inspected

The "Parameters Monitored/Inspected" program element in Appendix A.1.2.3.3 of the SRP-LR can be summarized as:

The parameters to be monitored or inspected should be identified and linked to the degradation of the particular structure and component intended function(s).

For condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects.

For performance monitoring program, a link should be established between degradation of the particular structure or component intended function(s) and the parameter being monitored.

For prevention and mitigation programs, the parameter monitored should be the specific parameter being controlled to achieve prevention or mitigation of aging effects.

The applicant stated in PNPS AMP B.1.32.1, for the "Parameters Monitored/Inspected" program element, that in accordance with industry recommendations, stator cooling water parameters monitored are conductivity, corrosion products, and dissolved oxygen. City water used in the potable and sanitary water system is monitored and treated by the town of Plymouth to meet the regulations of the Commonwealth of Massachusetts.

The project team determined that the "Parameters Monitored/Inspected" program element satisfies the criteria defined in Appendix A.1.2.3.3 of the SRP-LR. Because the applicant has identified the parameters monitored, on this basis the project team found that the applicant's description of the "Parameters Monitored/Inspected" is acceptable.

3.0.3.3.6.1.4 <u>Detection of Aging Effects</u>

The "Detection of Aging Effects" program element in Appendix A.1.2.3.4 of the SRP-LR can be summarized as:

> Provide information that links the parameters to be monitored or inspected to the aging effects being managed.
>
> Describe when, where, and how program data are collected (i.e., all aspects of activities to collect data as part of the program).
>
> Link the method or technique and frequency, if applicable, to plant-specific or industry-wide operating experience.
>
> Provide the basis for the inspection population and sample size when sampling is used to inspect a group of SCs. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.



The applicant stated in PNPS AMP B.1.32.1 for the "Detection of Aging Effects" program element that the program manages loss of material for stator cooling water system and potable and sanitary water system components.

The One-Time Inspection Program describes inspections planned to verify the effectiveness of water chemistry control programs to ensure that significant degradation is not occurring and component intended function is maintained during the period of extended operation.

The project team noted that frequency of sampling water chemistry was not identified. The project team asked the applicant to provide the frequencies. In its response, the applicant stated that stator cooling water conductivity is monitored continuously using three conductivity elements with remote readouts and alarms. Dissolved oxygen is measured using a portable oxygen meter with a continuous local display. The oxygen meter is read weekly and the value is recorded. If the oxygen meter is out of service, a weekly grab sample is obtained and a chemical analysis is performed. Monthly copper analyses are performed to monitor for corrosion.

1. Three installed plant conductivity elements (P&ID M275) are read out remotely and are alarmed for Operations. In addition, one portable conductivity meter is kept in Sample Panel C-3006, and it only has a local readout. Normally, the portable meter satisfies procedure PNPS 7.8.1 grab sample requirement. However, we are considering removing the portable meter from the sample panel and just using the installed conductivity elements. With three conductivity elements, there is more than enough monitoring.

2. The only oxygen meter is portable and located in Sample Panel C-3006. The meter has a continuous local readout display, but it has no readout or alarms. It is read weekly and the value is recorded. If the oxygen meter is out of service, a weekly grab sample is obtained and a chemical analysis is performed.

3. PNPS does not performcorrosion products analyses; only copper analyses are performed.

Since the applicant has identified the frequencies, the project team found the applicant response to be acceptable.

The project team determined that this programelement satisfies the criteria defined in Appendix A.1.2.3.4 of the SRP-LR. Based on the above response and considering that one-time inspection will be performed to verify effectiveness of this chemistry program, the project team found that the applicant's description of the "Detection of Aging Effects" is acceptable.



3.0.3.3.6.1.5 Monitoring and Trending

The "Monitoring and Trending" program element in Appendix A.1.2.3.5 of the SRP-LR can be summarized as:

> 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 are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The applicant stated in PNPS AMP B.1.32.1, for the "Monitoring and Trending" program element, that values from analyses are archived for long-term trending and review.

The project team reviewed Procedure 7.8.7, Reading and Trending of Chemistry Data, and concluded that appropriate trending is being performed.

The project team determined that this programelement satisfies the criteria defined in Appendix A.1.2.3.5 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Monitoring and Trending" is acceptable.

3.0.3.3.6.1.6 Acceptance Criteria

The "Acceptance Criteria" program element in Appendix A.1.2.3.6 of the SRP-LR can be summarized as:

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

The program should include a methodology for analyzing the results against applicable acceptance criteria.

Qualitative 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 stated in PNPS AMP B.1.32.1, for the "Acceptance Criteria" program element, that in accordance with industry recommendations, acceptance criteria for the stator cooling water system are as follows.

- Conductivity < 0.3 S/cm.
- Dissolved oxygen ≥ 2.0 ppm / ≤ 8.0 ppm.
- Corrosion products no detectable activity.



However, the project team noted that the units for conductivity were incorrect. Also, as stated in 3.0.3.3.6.1.4 above, PNPS does not perform corrosion products analyses. Instead, copper analyses are performed. The project team asked the applicant to clarify the units and the statement on corrosion products. In a letter dated **mm-dd-yyyy (MLaaaaaaaa)**, the applicant stated that it was an error created by a software conversion error. Element 6 of the LRA Section B.1.32.1 will be amended to correct the units of conductivity to $\mu$S/cm and delete the acceptance criteria for corrosion products. Corrosion product (copper) sampling is used to determine the type of copper oxide layer formed. Thus, it is a diagnostic parameter without an acceptance criteria. **(Open Item).**

The project team reviewed PNPS Procedure No. 7.8.1, Rev. 40, Chemistry Sample and Analysis Program Procedure and determined that the response was acceptable.

The project team determined this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.6 of the SRP-LR. Since specific values are identified, the project team found that the applicant's description of the "Acceptance Criteria" is acceptable.

3.0.3.3.6.1.7 <u>Corrective Actions</u>

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element was reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.7 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Corrective Actions" is acceptable.

3.0.3.3.6.1.8 Confirmation Process

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element was reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.8 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Confirmation Process" is acceptable.

3.0.3.3.6.1.9 Administrative Controls

The adequacy of the applicant's 10 CFR 50, Appendix B Program associated with this program element was reviewed by the NRR DE staff and addressed in Section 3 of the SER related to the PNPS LRA.

The project team reviewed other aspects of this program element to determine whether or not it satisfies the criteria defined in Appendix A.1.2.3.9 of the SRP-LR. On this basis, the project team found that the applicant's description of the "Administrative Controls" is acceptable.



3.0.3.3.6.1.10 Operating Experience

The "Operating Experience" program element criteria in Appendix A.1.2.3.10 of the SRP-LR can be summarized as:

> 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.
>
> An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The applicant stated, in the PNPS LRA, for the "Operating Experience" program element, that in spring 2001, a small leak of hydrogen into the stator coolant that caused displacement of oxygen was identified and repaired. Continuous confirmation of stator cooling water quality and timely corrective actions provides evidence that the program is effective in managing loss of material for stator cooling water system components.

Stator cooling water sample results between October 2001 and January 2002 revealed oxygen concentrations below the acceptance criterion of 2 ppm. Feed and bleed operations were used to introduce atmospheric oxygen into the cooling water to correct the oxygen level. Oxygen levels did not go below 0.76 ppm and copper concentrations remained normal with no adverse trend. Continuous confirmation of stator cooling water quality and timely corrective actions provides evidence that the programis effective in managing loss of material for stator cooling water system components.

Stator cooling water sample results for the period 1/1/2004 through 9/7/2005 revealed only two instances of a parameter outside the acceptance criteria. On 7/1/04, measured dissolved oxygen was 1.84 ppm. The acceptance criterion for dissolved oxygen is > 2.0 ppm and < 8.0 ppm. Subsequent readings were within the acceptance criterion and corrective action was not required. On 4/7/05, measured dissolved oxygen was 0.90 ppm. In this instance, it was determined that the oxygen probe had failed. Grab sample analysis resulted in a dissolved oxygen reading within acceptance criteria. Continuous confirmation of stator cooling water quality provides evidence that the program is effective in managing loss of material for stator cooling water system components.

QA audits in 2000, 2002, and 2004 revealed no issues or findings that could impact effectiveness of the program.

The project team reviewed Project Operating Experience Review Report, LRPD-05, Revision 0, Section 4.1.27, Water Chemistry Control - Auxiliary Systems Program. Several instances where the limit levels were exceeded are identified, with appropriate actions taken. The program is effective in managing aging effects. The project team reviewed CR-PNP-2001-09096 regarding dissolved oxygen levels in stator cooling water decreasing below acceptable levels. The project team reviewed the CR and determined that appropriate corrective action as required by this programwas performed and the necessary corrective actions were completed.

The project team reviewed the operating experience provided in the PNPS 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 concluded that the applicant's Water Chemistry Control – Auxiliary Systems Programwill adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.3.6.2 UFSAR Supplement

The applicant provided its UFSAR Supplements for the Water Chemistry Control – Auxiliary Systems Programin the PNPS LRA, Appendix A, Section A.2.1.36, which states that the purpose of the Water Chemistry Control – Auxiliary Systems Program is to manage loss of material for components exposed to treated water.

Programactivities include sampling and analysis of the stator cooling water system to minimize component exposure to aggressive environments.

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).

3.0.3.3.6.3 Conclusion

On the basis of its audit and review of the applicant's program, the project team found 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 found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 3.1 Aging Management of Reactor Vessel, Reactor Internals, and Reactor Coolant Systems

This section of the audit and review report documents the project team's review and evaluation of PNPS aging management review (AMR) results for the aging management of the reactor vessel, internals, and reactor coolant systems component and component groups associated with the following systems: (1) reactor vessel, (2) reactor vessel internals, and (3) reactor coolant pressure boundary.

### 3.1.1 Summary of Technical Information in the Application

In the PNPS LRA Section 3.1, the applicant provided the results of its AMRs for the reactor vessel, internals, and reactor coolant systems components and component groups.

In PNPS LRA Table 3.1.1, "Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801," the applicant provided a summary comparison of its AMR line-items with the AMR line-items evaluated in the GALL Report for the reactor vessel, internals, and reactor coolant systems components and component groups. The applicant also identified for each component type in the PNPS LRA Table 3.1.1 those components that are consistent with the GALL Report, those for 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.



In the PNPS LRA Tables 3.1.2-1 through 3.1.2-3, the applicant provided a summary of the AMR results for component types associated with (1) reactor vessel, (2) reactor vessel internals, and (3) reactor coolant pressure boundary. Specifically, the 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 PNPS LRA Table 3.1.1 (Table 1), and generic and plant-specific notes related to consistency with the GALL Report.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effect requiring managements (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

### 3.1.2 Project Team Evaluation

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

The project team reviewed certain identified AMR line-items to confirm the applicant's claim that these AMR line-items were consistent with the GALL Report. The project team did not repeat its review of the matters described in the GALL Report. However, the project team did verify that the material presented in the PNPS LRA was applicable and that the applicant had identified the appropriate GALL Report AMR line-items. The project team's audit evaluation is documented in Section 3.1.2.1 of this audit and review report. In addition, the project team's evaluations of the AMPs are documented in Section 3.0.3 of this audit and review report.

The project team reviewed those selected AMR line-items for which further evaluation is recommended by the GALL Report. The project team confirmed that the applicant's further evaluations were in accordance with the acceptance criteria in SRP-LR. The project team's audit evaluation is documented in Section 3.1.2.2 of this audit and review report.

The project team also reviewed of the remaining AMR line-items that were not consistent with or not addressed in the GALL Report based on NRC-approved precedents. The audit included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The project team's evaluation is documented in Section 3.1.2.3 of this audit and review report.

Finally, the project team reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the reactor vessel, internals, and reactor coolant systems components.



Table 3.1-1 below provides a summary of the project team's evaluation of components, aging effects/aging mechanisms, and AMPs listed in LRA Section 3.1 that are addressed in the GALL Report. It also includes the section of the audit and review report in which the project team's evaluation is documented.

**Table 3.1-1 Project Team's Evaluation for LRA Section 3.1 - Reactor Vessel, Internals, and Reactor Coolant Systems Components in the GALL Report**

| Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.1.1-1 | Steel pressure vessel support skirt and attachment welds | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | TLAA Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. & 4.3.3 | |

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| | Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.1.1-2 | Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components | TLAA Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. & 4.3.3 | |
| 2 | 3.1.1-3 | Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor coolant pressure boundary piping, piping components, and piping elements exposed to reactor coolant | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components | TLAA Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. & 4.3.3 | |
| 3 | 3.1.1-4 | Steel pump and valve closure bolting | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) check Code limits for allowable cycles (less than 7,000 cycles) of thermal stress range | TLAA Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. & 4.3.3 | |
| 4 | 3.1.1-5 | Stainless steel and nickel alloy reactor vessel internals components | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | TLAA Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. & 4.3.3 | |
| 5 | 3.1.1-6 | PWR only | | | | |
| 6 | 3.1.1-7 | PWR only | | | | |
| 7 | 3.1.1-8 | PWR only | | | | |

| | Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.1.1-9 | PWR only | | | | |
| 2 | 3.1.1-10 | PWR only | | | | |
| 3 | 3.1.1-11 | Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant | Loss of material due to general, pitting, and crevice corrosion | Water Chemistry and One-Time Inspection | Inservice Inspection Program; see Section 3.1.2.2.2 item 1 | |
| 4 | 3.1.1-12 | PWR only | | | | |
| 5 | 3.1.1-13 | Steel and stainless steel isolation condenser components exposed to reactor coolant | Loss of material due to general (steel only), pitting and crevice corrosion | Water Chemistry and One-Time Inspection | Inservice Inspection Program; see Section 3.1.2.2.2 item 2 | |
| 6 | 3.1.1-14 | Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspection | Inservice Inspection Program; see Section 3.1.2.2.2 item 3 | |
| 7 | 3.1.1-15 | Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant (Item 3.1.1-15) | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspection | Inservice Insp ection Program; see Section 3.1.2.2.2 item 3 | |
| 8 | 3.1.1-16 | PWR only | | | | |

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| | Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.1.1-17 | Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds | Loss of fracture toughness due to neutron irradiation embrittlement | TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations. | TLAA see Section 3.1.2.2.3 item 1 | |
| 2 | 3.1.1-18 | Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles | Loss of fracture toughness due to neutron irradiation embrittlement | Reactor Vessel Surveillance | Plant specific see Section 3.1.2.2.3 item 2 | |
| 3 | 3.1.1-19 | Stainless steel and nickel alloy top head enclosure vessel flange leak detection line | Cracking due to stress corrosion cracking and intergranular stress corrosion cracking | A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line. | Plant specific see Section 3.1.2.2.4 item 1 | |
| 4 | 3.1.1-20 | Stainless steel isolation condenser components exposed to reactor coolant | Cracking due to stress corrosion cracking and intergranular stress corrosion cracking | Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program | Not applicable PNPS does not have an isolation condenser | |
| 5 | 3.1.1-21 | PWR only | | | | |
| 6 | 3.1.1-22 | PWR only | | | | |
| 7 | 3.1.1-23 | PWR only | | | | |

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| Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.1.1-24 | PWR only | | | | |
| 3.1.1-25 | Stainless steel jet pump sensing line | Cracking due to cyclic loading | A plant-specific aging management program is to be evaluated. | | |
| 3.1.1-26 | Steel and stainless steel isolation condenser components exposed to reactor coolant | Cracking due to cyclic loading | Inservice Inspection (IWB, IWC, and IWD) and plant-specific verification program | | |
| 3.1.1-27 | PWR only | | | | |
| 3.1.1-28 | PWR only | | | | |
| 3.1.1-29 | Stainless steel steam dryers exposed to reactor coolant | Cracking due to flow-induced vibration | A plant-specific aging management program is to be evaluated. | | |
| 3.1.1-30 | PWR only | | | | |
| 3.1.1-31 | PWR only | | | | |
| 3.1.1-32 | PWR only | | | | |
| 3.1.1-33 | PWR only | | | | |
| 3.1.1-34 | PWR only | | | | |
| 3.1.1-35 | PWR only | | | | |
| 3.1.1-36 | PWR only | | | | |
| 3.1.1-37 | PWR only | | | | |
| 3.1.1-38 | Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant | Cracking due to cyclic loading | BWR CR Drive Return Line Nozzle | | |

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| | Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.1.1-39 | Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant | Cracking due to cyclic loading | BWR Feedwater Nozzle | | |
| 2 | 3.1.1-40 | Stainless steel and nickel alloy penetrations for control rod drive stub tubes instrumentation, jet pump instrument, standby liquid control, flux monitor, and drain line exposed to reactor coolant | Cracking due to stress corrosion cracking, Intergranular stress corrosion cracking, cyclic loading | BWR Penetrations and Water Chemistry | | |
| 3 | 3.1.1-41 | Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds | Cracking due to stress corrosion cracking and intergranular stress corrosion cracking | BWR Stress Corrosion Cracking and Water Chemistry | | |
| 4 | 3.1.1-42 | Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant | Cracking due to stress corrosion cracking and intergranular stress corrosion cracking | BWR Vessel ID Attachment Welds and Water Chemistry | | |
| 5 | 3.1.1-43 | Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant | Cracking due to stress corrosion cracking and intergranular stress corrosion cracking | BWR Vessel Internals and Water Chemistry | | |

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| | Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.1.1-44 | Stainless steel and nickel alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking | BWR Vessel Internals and Water Chemistry | | |
| 2 | 3.1.1-45. | Steel piping, piping components, and piping elements exposed to reactor coolant | Wall thinning due to flow-accelerated corrosion | Flow-Accelerated Corrosion | | |
| 3 | 3.1.1-46 | Nickel alloy core shroud and core plate access hole cover (mechanical covers) | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking | Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry | | |
| 4 | 3.1.1-47 | Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant | Loss of material due to pitting and crevice corrosion | Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry | | |
| 5 6 | 3.1.1-48 | Steel and stainless steel Class 1 piping, fittings and branch connections <NPS 4 exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal and mechanical loading | Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping | | |

**Pilgrim Nuclear Power Station Audit and Review Report**

| | Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.1.1-49 | Nickel alloy core shroud and core plate access hole cover (welded covers) | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking | Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and, for BWRs with a crevice in the access hole covers, augmented inspection using UT or other demonstrated acceptable inspection of the access hole cover welds | | |
| 2 | 3.1.1-50 | High-strength low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage | Cracking due to stress corrosion cracking and intergranular stress corrosion cracking | Reactor Head Closure Studs | | |
| 3 | 3.1.1-51 | Cast austenitic stainless steel jet pump assembly castings; orificed fuel support | Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement | Thermal Aging and Neutron Irradiation Embrittlement of CASS | | |
| 4 | 3.1.1-52 | Steel and stainless steel reactor coolant pressure boundary (RCPB) pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature systems | Cracking due to stress corrosion cracking, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening | Bolting Integrity | | |

**Pilgrim Nuclear Power Station Audit and Review Report**

| | Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.1.1-53 | Steel piping, piping components, and piping elements exposed to closed cycle cooling water | Loss of material due to general, pitting, and crevice corrosion | Closed-Cycle Cooling Water System | | |
| 2 | 3.1.1-54 | Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water | Loss of material due to pitting, crevice, and galvanic corrosion | Closed-Cycle Cooling Water System | | |
| 3 | 3.1.1-55 | Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250°C (>482°F) | Loss of fracture toughness due to thermal aging embrittlement | Inservice inspection (IWB, IWC, and IWD). Thermal aging susceptibility screening is not necessary, inservice inspection requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings. | | |
| 4 | 3.1.1-56 | Copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water | Loss of material due to selective leaching | Selective Leaching of Materials | | |

| | Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.1.1-57 | Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant >250°C (>482°F) | Loss of fracture toughness due to thermal aging embrittlement | Thermal Aging Embrittlement of CASS | | |
| 2 | 3.1.1-58 | PWR only | | | | |
| 3 | 3.1.1-59 | PWR only | | | | |
| 4 | 3.1.1-60 | PWR only | | | | |
| 5 | 3.1.1-61 | PWR only | | | | |
| 6 | 3.1.1-62 | PWR only | | | | |
| 7 | 3.1.1-63 | PWR only | | | | |
| 8 | 3.1.1-64 | PWR only | | | | |
| 9 | 3.1.1-65 | PWR only | | | | |
| 10 | 3.1.1-66 | PWR only | | | | |
| 11 | 3.1.1-67 | PWR only | | | | |
| 12 | 3.1.1-68 | PWR only | | | | |
| 13 | 3.1.1-69 | PWR only | | | | |
| 14 | 3.1.1-70 | PWR only | | | | |
| 15 | 3.1.1-71 | PWR only | | | | |
| 16 | 3.1.1-72 | PWR only | | | | |
| 17 | 3.1.1-73 | PWR only | | | | |
| 18 | 3.1.1-74 | PWR only | | | | |
| 19 | 3.1.1-75 | PWR only | | | | |
| 20 | 3.1.1-76 | PWR only | | | | |
| 21 | 3.1.1-77 | PWR only | | | | |

| Item No. | Component Group | Aging Effect, Aging Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.1.1-78 | PWR only | | | | |
| 3.1.1-79 | PWR only | | | | |
| 3.1.1-80 | PWR only | | | | |
| 3.1.1-81 | PWR only | | | | |
| 3.1.1-82 | PWR only | | | | |
| 3.1.1-83 | PWR only | | | | |
| 3.1.1-84 | PWR only | | | | |
| 3.1.1-85 | Nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) | None | None | | |
| 3.1.1-86 | Stainless steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (External); air with borated water leakage; concrete; gas | None | None | | |
| 3.1.1-87 | Steel piping, piping components, and piping elements in concrete | None | None | | |



### 3.1.2.1 AMR Results that Are Consistent with the GALL Report

Summary of Information in the Application

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 PNPS LRA is acceptable.

In PNPS LRA Section 3.1.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the reactor vessel, reactor vessel internals, and reactor coolant pressure boundary components:

- BWR CRD Return Line Nozzle Program (B.1.3)
- BWR Feedwater Nozzle Program (B.1.4)
- BWR Penetrations Program (B.1.5)
- BWR Stress Corrosion Cracking Program (B.1.6)
- BWR Vessel ID Attachment Welds Program (B.1.7)
- BWR Vessel Internals Program (B.1.8)
- Flow-Accelerated Corrosion Program (B.1.14)
- Inservice Inspection Program (B.1.16.2)
- One-Time Inspection Program (B.1.23)
- Reactor Head Closure Studs Program (B.1.25)
- Reactor Vessel Surveillance Program (B.1.26)
- System Walkdown Program (B.1.30)
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B.1.31)
- Water Chemistry Control – BWR Program (B.1.32.2)
- Water Chemistry Control – Closed Cooling Water Program (B.1.32.3)



Project Team Evaluation

In PNPS's LRA Tables 3.1.2-1 through 3.1.2-3, the applicant provides a summary of AMRs for the reactor vessel, reactor vessel internals, and reactor coolant pressure boundary components and identifies which AMRs it considers to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claims consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provides a note for each AMR line item in Tables 3.1.2-1 through 3.1.2-3. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR is consistent with the GALL Report.

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

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

Note C indicates that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging management program. In addition, the AMP is consistent with the AMP identified by the GALL Report. 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 staff audited these line items to verify consistency with the GALL Report. The staff also determined that the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

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

The staff conducted an audit and review of the information provided in the LRA, as documented in its PNPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

For aging management evaluations that the applicant stated are consistent with the GALL Report and for which further evaluation is not recommended, the staff conducted its audit of the LRA to determine if the applicant's reference to the GALL Report is acceptable.

The staff reviewed the PNPS LRA to confirm that the applicant: (1) provided a brief description of the system, components, materials, and environment, (2) stated that the applicable aging effects had been reviewed and are evaluated in the GALL Report, and (3) identifies those aging effects for the reactor vessel, reactor vessel internals, and reactor coolant pressure boundary components subject to an AMR.

[This section addresses consistency with the GALL Report. For each Tables 1 entry for which no further evaluation is required by the SRP-LR and the project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicant's basis for why it is acceptable. Identify documents reviewed, full title, revision, and/or date of issue, and the reviewer's basis for accepting the differences. If additional information is requested from the applicant to develop an acceptable reviewer finding, cite the applicant's docketed letter, commitment or other docketed LRA supplement. The docketed item is to be cited by title, date and ADAMs accession number. **Use Template 5 below for this purpose**. There is to be a separate, numbered section for each aging effect in Table 1 that is to be discussed. Otherwise, there is no need to discuss that particular Table 1 entry]

[This section also addresses Table 2 regarding consistency with the GALL Report when project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicants basis for why it is acceptable (for example, a different Note is used). This section also addresses Note E and why using an AMP that is different than that recommended in GALL Report is acceptable (see Example 13 at the end of this document)]

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**Template 5 -** <u>**Aging Management Reviews Results That Are Consistent With the GALL Report - With Identified Difference/Issue**</u>

3.[Y].2.1.S] <u>Title of Aging Effect/Mechanism</u>

In the discussion section of Table 3.Y.1, Item [NUMBER]of the [PLANTACRONYM] LRA, the applicant stated that [provide description of in the LRA]. During the audit and review, the project team noted that [provide description of differences, the applicant's basis.]

[ Identify documents reviewed and basis for acceptability, project team evaluation]

On the basis of its review, the project team found that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.



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<u>Conclusion</u>

The project team evaluated the applicant's claim of consistency with the GALL Report. The project team also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the project team found that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team found that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.1.2.2 AMR Results For Which Further Evaluation Is Recommended By The GALL Report

For some line items in the PNPS LRA Tables 3.1.2-1 through 3.1.2-3 that are identified to be consistent with the GALL Report, the applicant cross-referenced specific line items in the LRA Table 3.1.1, for which the GALL Report recommends further evaluation. Where the GALL Report recommends further evaluation, the project team reviewed the applicable further evaluations provided in LRA Sections 3.1.2.2, 3.2.2.2, 3.3.2.2, 3.4.2.2, 3.5.2.2, and 3.6.2.2 against the criteria provided in the SRP-LR Sections 3.1.2.2, 3.2.2.2, 3.3.2.2, 3.4.2.2, 3.5.2.2, and 3.6.2.2 respectively. The following provides the staff's assessment of the applicant's further evaluations.

Summary of Information in the Application

In PNPS's LRA Section 3.1.2.2, the applicant provides further evaluation of aging management as recommended by the GALL Report for the isolation condenser system; nuclear boiler instrumentation system; reactor head cooling system; reactor internals; reactor pressure vessel; and reactor recirculation system components and component groups. The applicant also provided information concerning how it will manage the related aging effects.

Project Team Evaluation

For some AMR line-items assigned to the project team in the PNPS LRA Table 3.1.1, the GALL Report recommends further evaluation. Where further evaluation is recommended, the project team reviewed these evaluations provided in PNPS LRA Section 3.1.2.2 against the criteria provided in the SRP-LR Section 3.1.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 AMR line-item in Section 3.1 citing the item in Table 1.

3.1.2.2.1 Cumulative Fatigue Damage

In the PNPS LRA Section 3.1.2.2.1, the applicant states that fatigue is a TLAA, as defined in 10 CFR 54.3 and TLAAs are evaluated in accordance with 10 CFR 54.21(C)(1). The project team's evaluation of this TLAA is addressed separately in Section 4 of the SER related to the PNPS LRA.



3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

3.1.2.2.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.1.2.2.2.1 against the criteria in SRP-LR Section 3.1.2.2.2.1.

SRP-LR Section 3.1.2.2.2.1 stated that the loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam. Loss of material due to general, pitting, and crevice corrosion could also occur for the steel top head enclosure (without cladding) top head nozzles [vent, top head spray or reactor core isolation cooling (RCIC), and spare] exposed to reactor coolant. The GALL Report recommends further evaluation of programs 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 the PNPS LRA Section 3.1.2.2.2.1, the applicant addresses the loss of material due to general, pitting, and crevice corrosion in steel components of the reactor vessel exposed to reactor coolant. The PNPS LRA states that the aging effect is managed by the PNPS Water Chemistry Control – BWR Program. In addition, the PNPS LRA states that the effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection

Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow. The Inservice Inspection Program supplements the Water Chemistry Control - BWR Program for these components.

[ Identify documents reviewed and basis for acceptability. project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.2.1 for further evaluation. The project team found 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).

3.1.2.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 2]

The project team reviewed PNPS LRA Section 3.1.2.2.2.2 against the criteria in SRP-LR Section 3.1.2.2.2.2.

SRP-LR Section 3.1.2.2.2.2 states that the loss of material due to pitting and crevice corrosion could occur in stainless steel BWR isolation condenser components exposed to reactor coolant. Loss of material due to general, pitting, and crevice corrosion could occur in steel BWR isolation condenser components. The GALL Report recommends further evaluation of programs 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 the PNPS LRA Section 3.1.2.2.2.2, the applicant stated that this section of the SRP-LRA pertains to BWR isolation condenser components. PNPS does not have an isolation condenser, however, the loss of material due to general, pitting, and crevice corrosion in other steel components within the reactor coolant pressure boundary exposed to reactor coolant is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow. For some components, the Inservice Inspection Program supplements the Water Chemistry Control - BWR Program.

[ Identify documents reviewed and basis for acceptability. project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.2.2 for further evaluation. The project team found 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).

3.1.2.2.2.3 Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 3]

The project team reviewed PNPS LRA Section 3.1.2.2.2.3 against the criteria in SRP-LR Section 3.1.2.2.2.2.3.

SRP-LR Section 3.1.2.2.2.3 states that the loss of material due to pitting and crevice corrosion could occur for stainless steel, nickel alloy, and steel with stainless steel or nickel alloy cladding flanges, nozzles, penetrations, pressure housings, safe ends, and vessel shells, heads and welds exposed to reactor coolant. The GALL Report recommends further evaluation of programs 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 the PNPS LRA Section 3.1.2.2.2.3, the applicant addressed the loss of material due to general, pitting, and crevice corrosion in stainless steel, nickel-alloy and steel with stainless steel cladding components of the reactor vessel, and loss of material in stainless steel (including CASS) components of the reactor coolant pressure boundary exposed to reactor coolant is managed at PNPS by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow. The One-Time Inspection Program is also used to manage loss of material for the main steam flow restrictors by means of a component specific inspection. For some components, the Inservice Inspection or BWR Vessel Internals Program supplements the Water Chemistry Control - BWR Program.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.2.3 for further evaluation. The project team found 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).

3.1.2.2.2.4 <u>Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 4]</u>

The project team reviewed PNPS LRA Section 3.1.2.2.2.4 against the criteria in SRP-LR Section 3.1.2.2.2.2.4.

SRP-LR Section 3.1.2.2.2.4 states that the loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. The existing program relies on control of chemistry to mitigate corrosion and Inservice Inspection (ISI) to detect loss of material. The extent and schedule of the existing steam generator inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, according to NRC Information Notice (IN) 90-04, the program may not be sufficient to detect pitting and crevice corrosion, if general and pitting corrosion of the shell is known to exist. The GALL Report recommends augmented inspection to manage this aging effect. Furthermore, the GALL Report clarifies that this issue is limited to Westinghouse Model 44 and 51 Steam Generators where a high stress region exists at the shell to transition cone weld. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.2.4, the applicant identifies that this section is applicable to Westinghouse Model 44 and 51 Steam Generators in PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.3 <u>Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement</u>

3.1.2.2.3.1 <u>Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement [Item 1]</u>

The project team reviewed PNPS LRA Section 3.1.2.2.3.1 against the criteria in SRP-LR Section 3.1.2.2.3.1.

SRP-LR Section 3.1.2.2.3.1 states that neutron irradiation embrittlement is a TLAA to be evaluated for the period of extended operation for all ferritic materials that have a neutron fluence greater than 1,017 n/cm$^2$ (E >1 MeV) at the end of the license renewal term. Certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). This TLAA is addressed separately in Section 4.2, "Reactor Vessel Neutron Embrittlement Analysis," of this SRP-LR.

In the PNPS LRA Section 3.1.2.2.3.1, the applicant states that neutron irradiation embrittlement is a TLAA evaluated for the period of extended operation in accordance with 10 CFR 54.21(c). The evaluation of loss of fracture toughness for the reactor vessel beltline shell and welds is discussed in Section 4.2.

[Identify documents reviewed and basis for acceptability. project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.3.1 for further evaluation. The project team found 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).

3.1.2.2.3.2 <u>Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement [Item 2]</u>

The project team reviewed PNPS LRA Section 3.1.2.2.3.2 against the criteria in SRP-LR Section 3.1.2.2.3.2.

SRP-LR Section 3.1.2.2.3.2 states that the loss of fracture toughness due to neutron irradiation embrittlement could occur in BWR and PWR reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance program is plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further staff evaluation is required for license renewal. Specific recommendations for an acceptable AMP are provided in Chapter XI, Section M31 of the GALL Report.

In the PNPS LRA Section 3.1.2.2.3.2, the applicant states that the Reactor Vessel Surveillance Program manages reduction of fracture toughness due to neutron embrittlement of reactor vessel beltline materials. PNPS is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) (see Reactor Vessel Surveillance Program in Appendix B). This program monitors changes in the fracture toughness properties of ferritic materials in the reactor vessel (RV) beltline region.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.3.2 for further evaluation. The project team found 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).

### 3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking



#### 3.1.2.2.4.1 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking [Item 1]

The project team reviewed PNPS LRA Section 3.1.2.2.4.1 against the criteria in SRP-LR Section 3.1.2.2.4.1.

SRP-LR Section 3.1.2.2.4.1 states that cracking due to SCC and IGSCC could occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.4.1, the applicant states that the Water Chemistry Control–BWR and One-Time Inspection Programs will manage cracking due to SCC and IGSCC in the stainless steel head seal leak detection lines. The One-Time Inspection Program will include a volumetric examination for the detection of cracking.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.4.1 for further evaluation. The project team found 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).

3.1.2.2.4.2 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking [Item 2]

The project team reviewed PNPS LRA Section 3.1.2.2.4.2 against the criteria in SRP-LR Section 3.1.2.2.4.2.

SRP-LR Section 3.1.2.2.4.2 states that cracking due to SCC and IGSCC could occur in stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program relies on control of reactor water chemistry to mitigate SCC and on ASME Section XI ISI. However, the existing program should be augmented to detect cracking due to SCC and IGSCC. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water, and eddy current testing of tubes to ensure that the component's intended function will be maintained during the period of extended operation. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.4.2, the applicant states that this section pertains to BWRs with isolation condenser components. PNPS does not have an isolation condenser, therefore, this section is not applicable.

The project team found that this section does not apply to PNPS.



3.1.2.2.5 Crack Growth Due to Cyclic Loading

The project team reviewed PNPS LRA Section 3.1.2.2.5 against the criteria in SRP-LR Section 3.1.2.2.5.

SRP-LR Section 3.1.2.2.5 states that crack growth due to cyclic loading could occur in reactor vessel shell forgings clad with stainless steel using a high-heat-input welding process. Growth of intergranular separations (underclad cracks) in the heat affected zone under austenitic stainless steel cladding is a TLAA to be evaluated for the period of extended operation for all the SA 508-Cl 2 forgings where the cladding was deposited with a high heat input welding process. The methodology for evaluating the underclad flaw should be consistent with the current well-established flaw evaluation procedure and criterion in the ASME Section XI Code. See the SRP-LR, Section 4.7, "Other Plant-Specific Time-Limited Aging Analysis," for generic guidance for meeting the requirements of 10 CFR 54.21(c).

In the PNPS LRA Section 3.1.2.2.5, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.6 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and Void Swelling

The project team reviewed PNPS LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6.

SRP-LR Section 3.1.2.2.6 states that the loss of fracture toughness due to neutron irradiation embrittlement and void swelling could occur in stainless steel and nickel alloy reactor vessel internals components exposed to reactor coolant and neutron flux. The GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

In the PNPS LRA Section 3.1.2.2.6, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.7 Cracking Due to Stress Corrosion Cracking

3.1.2.2.7.1 Cracking Due to Stress Corrosion Cracking [Item 1]

The project team reviewed PNPS LRA Section 3.1.2.2.7.1 against the criteria in SRP-LR Section 3.1.2.2.7.1.



SRP-LR Section 3.1.2.2.7.1 states that cracking due to SCC could occur in the PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. The GALL Report recommends that a plant specific AMP be evaluated to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.7.1, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.7.2 Cracking Due to Stress Corrosion Cracking [Item 2]

The project team reviewed PNPS LRA Section 3.1.2.2.7.2 against the criteria in SRP-LR Section 3.1.2.2.7.2.

SRP-LR Section 3.1.2.2.7.2 states that cracking due to SCC could occur in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping, piping components, and piping elements exposed to reactor coolant. The existing program relies on control of water chemistry to mitigate SCC; however SCC could occur for CASS components that do not meet the NUREG-0313 guidelines with regard to ferrite and carbon content. The GALL Report recommends further evaluation of a plant specific program for these components to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

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In the PNPS LRA Section 3.1.2.2.7.2, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.8 Cracking Due to Cyclic Loading

3.1.2.2.8.1 Cracking Due to Cyclic Loading [Item 1]

The project team reviewed PNPS LRA Section 3.1.2.2.8.1 against the criteria in SRP-LR Section 3.1.2.2.8.1.

SRP-LR Section 3.1.2.2.8.1 states that cracking due to cyclic loading could occur in the stainless steel BWR jet pump sensing lines. The GALL Report recommends that a plant specific AMP be evaluated to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.8.1, the applicant states that this section pertains to the jet pump sensing lines inside the reactor vessel. At PNPS, these lines have no license renewal intended function and thus are not subject to aging management review.

The jet pump instrumentation provides indication of jet pump flow. As the jet pump flow is not a safety related function, indication of that flow is not a license renewal function. The lines inside the vessel do not contribute to the pressure boundary. The lines outside the vessel are part of the RCS pressure boundary and are subject to aging management review.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.8.1 for further evaluation. The project team found 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).

3.1.2.2.8.2 Cracking Due to Cyclic Loading [Item 2]

The project team reviewed PNPS LRA Section 3.1.2.2.8.2 against the criteria in SRP-LR Section 3.1.2.2.8.2.

SRP-LR Section 3.1.2.2.8.2 states that cracking due to cyclic loading could occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program relies on ASME Section XI ISI. However, the existing program should be augmented to detect cracking due to cyclic loading. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water, and eddy current testing of tubes to ensure that the component's intended function will be maintained during the period of extended operation. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.8.2, the applicant states that this section pertains to BWR isolation condenser components. Because PNPS does not have an isolation condenser, this section is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

The project team reviewed PNPS LRA Section 3.1.2.2.9 against the criteria in SRP-LR Section 3.1.2.2.9.

SRP-LR Section 3.1.2.2.9 states that the loss of preload due to stress relaxation could occur in stainless steel and nickel alloy PWR reactor vessel internals screws, bolts, tie rods, and hold-down springs exposed to reactor coolant. The GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

In the PNPS LRA Section 3.1.2.2.9, the applicant states that this section applies to PWRs and is not applicable to PNPS.



The project team found that this section is not applicable to PNPS.

3.1.2.2.10 Loss of Material Due to Erosion

The project team reviewed PNPS LRA Section 3.1.2.2.10 against the criteria in SRP-LR Section 3.1.2.2.10.

SRP-LR Section 3.1.2.2.10 states that the loss of material due to erosion could occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.10, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.11 Cracking Due to Flow-Induced Vibration

The project team reviewed PNPS LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

SRP-LR Section 3.1.2.2.11 states that cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.11, the applicant states that cracking due to flow-induced vibration in the stainless steel steam dryers is managed by the BWR Vessel Internals Program. The BWR Vessel Internals Program incorporates the guidelines of GE-SIL-644, Revision 1. PNPS will evaluate BWR VIP-139 upon approval by the NRC staff and either include its recommendatons in the PNPS BWR Vessel Internals Program or inform the staff of PNPS's exceptions to that document.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.11 for further evaluation. The project team found 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).

3.1.2.2.12 Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking



The project team reviewed PNPS LRA Section 3.1.2.2.12 against the criteria in SRP-LR Section 3.1.2.2.12.

SRP-LR Section 3.1.2.2.12 states that cracking due to SCC and IASCC could occur in PWR stainless steel reactor internals exposed to reactor coolant. The existing program relies on control of water chemistry to mitigate these effects. The GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

In the PNPS LRA Section 3.1.2.2.12, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.13 Cracking Due to Primary Water Stress Corrosion Cracking (PWSCC)

The project team reviewed PNPS LRA Section 3.1.2.2.13 against the criteria in SRP-LR Section 3.1.2.2.13.

SRP-LR Section 3.1.2.2.13 states that cracking due to PWSCC could occur in PWR components made of nickel alloy and steel with nickel alloy cladding, including reactor coolant pressure boundary components and penetrations inside the RCS such as pressurizer heater sheathes and sleeves, nozzles, and other internal components. With the exception of reactor vessel upper head nozzles and penetrations, the GALL Report recommends ASME Section XI ISI (for Class 1 components) and control of water chemistry. For nickel alloy components, no further aging management review is necessary if the applicant complies with applicable NRC Orders and provides a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.

In the PNPS LRA Section 3.1.2.2.13, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion

The project team reviewed PNPS LRA Section 3.1.2.2.14 against the criteria in SRP-LR Section 3.1.2.2.14.

SRP-LR Section 3.1.2.2.14 states that wall thinning due to flow-accelerated corrosion could occur in steel feedwater inlet rings and supports. The GALL Report references NRC IN 91-19, "Steam Generator Feedwater Distribution Piping Damage," for evidence of flow accelerated corrosion in steam generators and recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting wall thinning due to flow-accelerated corrosion. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.1.2.2.14, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.15 Changes in Dimensions Due to Void Swelling

The project team reviewed PNPS LRA Section 3.1.2.2.15 against the criteria in SRP-LR Section 3.1.2.2.15.

SRP-LR Section 3.1.2.2.15 states that changes in dimensions due to void swelling could occur in stainless steel and nickel alloy PWR reactor internal components exposed to reactor coolant. The GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

In the PNPS LRA Section 3.1.2.2.15, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.16 <u>Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking</u>

3.1.2.2.16.1 <u>Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking [Item 1]</u>

The project team reviewed PNPS LRA Section 3.1.2.2.16.1 against the criteria in SRP-LR Section 3.1.2.2.16.1.

SRP-LR Section 3.1.2.2.16.1 states that cracking due to SCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel. Cracking due to PWSCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tubesheet welds made or clad with nickel alloy. The GALL Report recommends ASME Section XI ISI and control of water chemistry to manage this aging and recommends no further aging management review for PWSCC of nickel alloy if the applicant complies with applicable NRC Orders and provides a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.



In the PNPS LRA Section 3.1.2.2.16.1, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.16.2 <u>Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking [Item 2]</u>

The project team reviewed PNPS LRA Section 3.1.2.2.16.2 against the criteria in SRP-LR Section 3.1.2.2.16.2.

SRP-LR Section 3.1.2.2.16.2 states that cracking due to SCC could occur on stainless steel pressurizer spray heads. Cracking due to PWSCC could occur on nickel-alloy pressurizer spray heads. The existing program relies on control of water chemistry to mitigate this aging effect. The GALL Report recommends one-time inspection to confirm that cracking is not occurring. For nickel alloy welded spray heads, the GALL Report recommends no further aging management review if the applicant complies with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.

In the PNPS LRA Section 3.1.2.2.16.2, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.17 Cracking Due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

The project team reviewed PNPS LRA Section 3.1.2.2.17 against the criteria in SRP-LR Section 3.1.2.2.17.

SRP-LR Section 3.1.2.2.17 states that cracking due to SCC, PWSCC, and IASCC could occur in PWR stainless steel and nickel alloy reactor vessel internals components. The existing program relies on control of water chemistry to mitigate these effects. However, the existing program should be augmented to manage these aging effects for reactor vessel internals components. The GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

In the PNPS LRA Section 3.1.2.2.17, the applicant states that this section applies to PWRs and is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.

3.1.2.2.18 Quality Assurance for Aging Management of Nonsafety-Related Components

SRP-LRA Section 3.1.2.2.18 states that the acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2 of this SRP-LR).

PNPS LRA Section 3.1.2.2.18 states that the quality assurance procedures and administrative controls for aging management programs are described in Appendix B Section B.0.3.

Section B.0.3 of Appendix B of the PNPS LRA states that quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Conditions adverse to quality, such as failures, malfunctions, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the nonconformance is determined and that corrective action is taken to preclude recurrence. In addition, the root cause of the significant condition adverse to quality and the corrective action implemented are documented and reported to appropriate levels of management.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

PNPS LRA Section 3.1.2.2.18 is reviewed by NRR DE staff and will be addressed separately in Section 3 of the SER related to the PNPS LRA.

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 determined that the applicant adequately addressed the issues that were further evaluated. The project team found 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).

### 3.1.2.3 AMR Results That Are Not Consistent With The GALL Report Or Not Addressed In The GALL Report

Summary of Information in the Application

In PNPS LRA Table 3.1.1, Summary of Aging Management Evaluations for the Reactor Coolant System Evaluation in Chapter IV of NUREG-1801, the applicant provided information regarding components or material/environment combination in the GALL Report that it evaluated and identified as not applicable to its plant.

In PNPS LRA Tables 3.1.2.1-1 through 3.1.2.1-3, the applicant provided additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report. Specifically, the applicant indicated, via Notes F through J, that neither the identified component nor the material/ environment combination is evaluated in the GALL Report and provided information concerning how the aging effect will be managed.

Project Team Evaluation

The project team reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

Aging Effect/Mechanism in Table 3.1.1 that Are not Applicable for PNPS

[This section is for the write-up of the AMR line-items that the applicant claims are not used or not applicable to its plant in LRA Table 1. The write-up does not include the "further evaluation required" in Table 1 since they are evaluated in Section 3.[Y].2. In addition, the evaluation is not necessary if the plant is of a different vintage (PWR vs. BWR)]

The project team reviewed PNPS LRA Table 3.1.1, which provides a summary of aging management evaluations for the reactor vessel, internals, and reactor coolant systems evaluated in the GALL Report.

In PNPS LRA Table 3.1.1, item 3.1.1-20 discussion column the applicant states that the cracking due to stress corrosion cracking and integranular stress corrosion cracking of the stainless steel isolation condenser components exposed to reactor coolant is not applicable to PNPS because PNPS does not have an isolation condenser.

This item was evaluated in Section 3.1.2.2.4, Item 2 of the PNPS LRA and is not applicable to PNPS.

In PNPS LRA Table 3.1.1, item 3.1.1-26 discussion column the applicant states that the cracking due to cyclic loading of steel and stainless steel isolation condenser components exposed to reactor coolant is not applicable to PNPS because PNPS does not have an isolation condenser.

This item was evaluated in Section 3.2.2.8, Item 2 of the PNPS LRA and is not applicable to PNPS.

In PNPS LRA Table 3.1.1, Item 3.1.1-53 discussion column the applicant states that the loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to closed cycle cooling water is not applicable to PNPS because there are no steel components of the Class 1 reactor vessel, reactor internals or reactor coolant pressure boundary exposed to closed cycle cooling water at PNPS.

[The Project Team Evaluation - if applicable]

On the basis that there [is/are] no [list of applicable components] in the reactor vessel, internals, and reactor coolant systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.



In PNPS Table 3.1.1, Item 3.1.1-54 discussion column the applicant states that states that the loss of material due to general, pitting, and crevice corrosion of copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water is not applicable to PNPS because there are no copper alloy components of the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary exposed to closed cycle cooling water at PNPS.
[The Project Team Evaluation - if applicable]

On the basis that there [is/are] no [list of applicable components] in the reactor vessel, internals, and reactor coolant systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.1.1, Item 3.1.1-55 discussion column the applicant states that the loss of fracture toughness due to thermal aging embrittlement of cast austenitic stainless steel Class 1 pump casings, valve bodies, and bonnets exposed to reactor coolant >250°C (>482°F) is not applicable to PNPS because the In-Service Inspection (ISI) Program manages the reduction of fracture toughness in cast austenitic stainless steel components of the reactor coolant pressure boundary at PNPS.

[The Project Team Evaluation - if applicable]

On the basis that there [is/are] no [list of applicable components] in the reactor vessel, internals, and reactor coolant systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPs Table 3.1.1, Item 3.1.1-56 discussion column the applicant states that the loss of material due to selective leaching of copper alloy (>15% zinc) piping, piping components, and piping elements exposed to closed cycle cooling water is not applicable to PNPS because there are no copper alloy components in the Class 1 reactor vessel, vessel internals or ractor coolant pressure boundary at PNPS.

[The Project Team Evaluation - if applicable]

On the basis that there [is/are] no [list of applicable components] in the reactor vessel, internals, and reactor coolant systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.1.1, Item 3.1.1-87 discussion column the applicant states that the aging of steel piping, piping components, and piping elements in concrete is not applicable to PNPS because there are no components of the Class 1 reactor vessel, vessel internals, or reactor coolant pressure boundary exposed to concrete at PNPS.

[The Project Team Evaluation - if applicable]

On the basis that there [is/are] no [list of applicable components] in the reactor vessel, internals, and reactor coolant systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

[Repeat the above three paragraphs, if applicable, for all items that the applicant claims is not applicable to its plant]

[If there are RAIs or issues that affect all Tables, provide discussion and evaluation here]

[If the LRA lists a series of components which have no aging effect and therefore do not require aging management, the following writeup may be used, as appropriate.]

<u>Reactor Vessel, Internals, and Reactor Coolant Systems AMR Line Items that Have no Aging Effect (PNPS LRA Tables 3.1.2.1.1 through 3.1.2.1.6)</u>

In LRA Tables 3.1.2-1 through 3.1.2-3, the applicant identifies line-items where no aging effects were identified as a result of its aging review process. Specific instances in which the applicant states that no aging effects were identified occurred in the following areas:

- Components fabricated from low alloy steel with stainless steel cladding used for the containment dome upper closure head, reactor vessel flanges, reactor vessel shell, and reactor vessel nozzles that are subject to an indoor air environment require no AMR. The environment is not in the GALL for this component and material and the high component surface temperature precludes moisture accumulation that could result in corrosion.

On the basis of its review of current industry research and operating experience, the project team found that an indoor air environment on low allow steel with stainless steel cladding will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for low alloy steel components with stainless steel cladding exposed to an indoor air environment.

- Components fabricated from low alloy steel used for the safe ends and subject to an indoor air environment require no AMR. The environment is not in the GALL for this component and material and the high component surface temperature precludes moisture accumulation that could result in corrosion.

On the basis of its review of current industry research and operating experience, the project team found that an indoor air environment on low allow steel will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for low alloy steel components exposed to an indoor air environment.

- Components fabricated from carbon steel used piping and fittings subject to an indoor air environment require no AMR. The aging effect in the GALL for this component, material, and environment combination is not applicable and the high component surface temperature precludes moisture accumulation that could result in corrosion.

On the basis of its review of current industry research and operating experience, the project team found that an indoor air environment on carbon steel piping and fittings will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for carbon steel piping and fitting components exposed to an indoor air environment.

3.1.2.3.1 <u>Reactor Vessel - Summary of Aging Management Evaluation - PNPS LRA Table 3.1.2-1</u>

The Project Team reviewed the PNPS LRA Table 3.1.2-1 which summarizes the results of AMR evaluations for the reactor vessel component groups.

In the PNPS LRA Table 3.1.2-1 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].

The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.1.2-1 titled "Reactor Vessel - Summary of Aging Management Evaluation is acceptable.

3.1.2.3.2 Reactor Vessel Internals - Summary of Aging Management Evaluation - PNPS LRA Table 3.1.2-2

The Project Team reviewed the PNPS LRA Table 3.1.2-2 which summarizes the results of AMR evaluations for the reactor vessel internals component groups.

In the PNPS LRA Table 3.1.2-2 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].

The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.1.2-2 titled "Reactor Vessel Internals - Summary of Aging Management Evaluation is acceptable.

3.1.2.3.3 Reactor Coolant Pressure Boundary - Summary of Aging Management Evaluation - PNPS LRA Table 3.1.2-3



The Project Team reviewed the PNPS LRA Table 3.1.2-3 which summarizes the results of AMR evaluations for the reactor vessel component groups.

In the PNPS LRA Table 3.1.2-3 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].

The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.1.2-3 titled "Reactor Coolant Pressure Boundary - Summary of Aging Management Evaluation is acceptable.

On the basis of its audit and review of the applicant's program, the project team found 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, the project team found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not addressed in the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.1.3 Conclusion

On the basis of its review, the project team concluded that the applicant has demonstrated that the aging effects associated with the reactor vessel, internals, and reactor coolant systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR54.21(a)(3).

The project team also reviewed the applicable UFSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the reactor vessel, internals, and reactor coolant systems components, as required by 10 CFR54.21(d).

## 3.2 Aging Management of Engineered Safety Features

This section of the audit and review report document the project team's review and evaluation of PNPS aging management review (AMR) results for the aging management of the engineered safety features component and component groups associated with the following systems:

- residual heat removal system
- core spray system
- automatic depressurization system
- high pressure coolant injection system
- reactor core isolation cooling system
- standby gas treatment system
- primary containment penetrations

### 3.2.1 Summary of Technical Information in the Application

In the PNPS LRA Section 3.2, the applicant provided the results of its AMRs for the engineered safety features components and component groups.

In PNPS LRA Table 3.2.1, "Summary of Aging Management Programs for Engineered Safety Features in Chapter V of NUREG-1801," the applicant provided a summary comparison of its AMR line-items with the AMR line-items evaluated in the GALL Report for the engineered safety features components and component groups. The applicant also identified for each component type in the PNPS LRA Table 3.2.1 those components that are consistent with the GALL Report, those for 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.

In the PNPS LRA Tables 3.2.2-1 through 3.2.2-7, the applicant provided a summary of the AMR results for component types associated with (1) residual heat removal system, (2) core spray system, (3) automatic depressurization system, (4) high pressure coolant injection system, (5) reactor core isolation cooling system, (6) standby gas treatment system, and (7) primary containment penetrations. Specifically, the information for each component type includes intended function, material, environment, aging effect requiring management, AMPs, the GALL Report Volume 2 (NUREG-1801, Volume 2) item, cross reference to PNPS LRA Table 3.2.1 (Table 1), and generic and plant specific notes related to consistency with the GALL report.

The applicant's AMRs incorporate applicable operating experience in the determination of aging effect requiring managements (AERMs). These reviews include evaluation of plant-specific and industry operating experience. The plant-specific evaluation includes reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience includes a review of the GALL Report and operating experience issues identified since the issuance of the Gall Report.

### 3.2.2 Project Team Evaluation

The project team reviewed PNPS LRA Section 3.2 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the engineered safety features components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team reviewed certain identified AMR line-items to confirm the applicant's claim that these AMR line-items were consistent with the GALL Report. The project team did not repeat its review of the matters described in the GALL Report. However, the project team did verify that the material presented in the PNPS LRA was applicable and that the applicant had identified the appropriate GALL Report AMR line-items. The project team's audit evaluation is documented in Section 3.2.2.1 of this audit and review report. In addition, the project team's evaluations of the AMPs are documented in Section 3.0.3 of this audit and review report.

The project team reviewed those selected AMR line-items for which further evaluation is recommended by the GALL Report. The project team confirmed that the applicant's further evaluations were in accordance with the acceptance criteria in SRP-LR. The project team's audit evaluation is documented in Section 3.2.2.2 of this audit and review report.

The project team also reviewed of the remaining AMR line-items that were not consistent with or not addressed in the GALL Report based on NRC-approved precedents. The audit included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The project team's evaluation is documented in Section 3.2.2.3 of this audit and review report.

Finally, the project team reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the engineered safety features components.

Table 3.2-1 below provides a summary of the project team's evaluation of components, aging effects/aging mechanisms, and AMPs listed in LRA Section 3.2 that are addressed in the GALL Report. It also includes the section of the audit and review report in which the project team's evaluation is documented.

**Table 3.2-1 Staff Evaluation for Engineered Safety Features Components in the GALL Report**

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.2.1-1 | Steel and stainless steel piping, piping components, and piping elements in emergency core cooling system | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.2.1-3 | Stainless steel containment isolation piping and components internal surfaces exposed to treated water | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 2 | 3.2.1-4 | Stainless steel piping, piping components, and piping elements exposed to soil | Loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated. | | |
| 3 | 3.2.1-5 | Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 4 | 3.2.1-6 | Stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to pitting and crevice corrosion | Lubricating Oil Analysis and One-Time Inspection | | |
| 5 | 3.2.1-7 | Partially encased stainless steel tanks with breached moisture barrier exposed to raw water | Loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering. | | |
| 6 | 3.2.1-8 | Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal) | Loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated. | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.2.1-9 | Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil | Reduction of heat transfer due to fouling | Lubricating Oil Analysis and One-Time Inspection | | |
| 2 | 3.2.1-10 | Stainless steel heat exchanger tubes exposed to treated water | Reduction of heat transfer due to fouling | Water Chemistry and One-Time Inspection | | |
| 3 | 3.2.1-11 | Elastomer seals and components in standby gas treatment system exposed to air - indoor uncontrolled | Hardening and loss of strength due to elastomer degradation | A plant-specific aging management program is to be evaluated. | | |
| 4 | 3.2.1-13 | Steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled (internal) | Loss of material due to general corrosion and fouling | A plant-specific aging management program is to be evaluated. | | |
| 5 | 3.2.1-14 | Steel piping, piping components, and piping elements exposed to treated water | Loss of material due to general, pitting, and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 6 | 3.2.1-15 | Steel containment isolation piping, piping components, and piping elements internal surfaces exposed to treated water | Loss of material due to general, pitting, and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 7 | 3.2.1-16 | Steel piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to general, pitting, and crevice corrosion | Lubricating Oil Analysis and One-Time Inspection | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.2.1-17 | Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil | Loss of material due to general, pitting, crevice, and microbiologi cal ly-influenced corrosion | Buried Piping and Tanks Surveillance - or - Buried Piping and Tanks Inspection | | |
| 2 | 3.2.1- 18 | Stainless steel piping, piping components , and piping elements exposed to treated water > 60°C (> 140°F) | Cracking due to stress corrosion cracking and intergranular stress corrosion cracking | BWR Stress Corrosion Cracking and Water Chemistry | | |
| 3 | 3.2.1-1 9 | Steel piping, piping components , and piping elements exposed to steam or treated water | Wall thinning due to flow-accelera ted corrosion | Flow-Accelerated Corrosion | | |
| 4 | 3.2.1-20 | Cast austenitic sta inless steel piping, piping components , and piping elements exposed to treated water (borated or unborated) > 250°C (> 482°F) | Loss of fracture tough ness due to thermal aging embr ittlement | Thermal Aging Embrittlem ent of CASS | | |
| 5 | 3.2.1-21 | High-strength steel closure bolting exposed to air with steam or water leakage | Cracking due to cyclic loading, stress corrosion cracking | Bolting Integrity | | |
| 6 | 3.2.1-2 2 | Steel closure bolting exposed to air with steam or water leakage | Loss of material due to general corrosi on | Bolting Integrity | | |
| 7 | 3.2.1-2 3 | Steel bolting and closure bolting exposed to air - outdoor (external), or air - indoor uncontro lled (external) | Lo ss of material due to general, pitting, and crevice corrosion | Bolting Integrity | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.2.1-24 | Steel closure bolting exposed to air - indoor uncontrolled (external) | Loss of preload due to thermal effects, gasket creep, and self-loosening | Bolting Integrity | | |
| 2 | 3.2.1-25 | Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water > 60°C (> 140°F) | Cracking due to stress corrosion cracking | Closed-Cycle Cooling Water System | | |
| 3 | 3.2.1-26 | Steel piping, piping components, and piping elements exposed to closed cycle cooling water | Loss of material due to general, pitting, and crevice corrosion | Closed-Cycle Cooling Water System | | |
| 4 | 3.2.1-27 | Steel heat exchanger components exposed to closed cycle cooling water | Loss of material due to general, pitting, crevice, and galvanic corrosion | Closed-Cycle Cooling Water System | | |
| 5 | 3.2.1-28 | Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water | Loss of material due to pitting and crevice corrosion | Closed-Cycle Cooling Water System | | |
| 6 | 3.2.1-29 | Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water | Loss of material due to pitting, crevice, and galvanic corrosion | Closed-Cycle Cooling Water System | | |
| 7 | 3.2.1-30 | Stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water | Reduction of heat transfer due to fouling | Closed-Cycle Cooling Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.2.1-31 | External surfaces of steel components including ducting, piping, ducting closure bolting, and containment isolation piping external surfaces exposed to air - indoor uncontrolled (external); condensation (external) and air - outdoor (external) | Loss of material due to general corrosion | External Surfaces Monitoring | | |
| 2 | 3.2.1-32 | Steel piping and ducting components and internal surfaces exposed to air - indoor uncontrolled (Internal) | Loss of material due to general corrosion | Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components | | |
| 3 | 3.2.1-33 | Steel encapsulation components exposed to air - indoor uncontrolled (internal) | Loss of material due to general, pitting, and crevice corrosion | Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components | | |
| 4 | 3.2.1-34 | Steel piping, piping components, and piping elements exposed to condensation (internal) | Loss of material due to general, pitting, and crevice corrosion | Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components | | |
| 5 | 3.2.1-35 | Steel containment isolation piping and components internal surfaces exposed to raw water | Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.2.1-36 | Steel heat exchanger components exposed to raw water | Loss of material due to general, pitting, crevice, galvanic, and microbiologic ally-influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 2 | 3.2.1-37 | Stainless steel piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting, crevice, and micro biological ly-influenced corrosion | Open-Cycle Cooling Water System | | |
| 3 | 3.2.1-38 | Stainless steel containment isolation piping and components internal surfaces exposed to raw water | Loss of material due to pitting, crevice, and micro biological ly-influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 4 | 3.2.1-39 | Stainless steel heat exchanger components exposed to raw water | Loss of material due to pitting, crevice, and micro biological ly-influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 5 | 3.2.1-40 | Steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water | Reduction of heat transfer due to fouling | Open-Cycle Cooling Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.2.1-41 | Copper alloy >15% Zn piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water | Loss of material due to selective leaching | Selective Leaching of Materials | | |
| 2 | 3.2.1-42 | Gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water | Loss of material due to selective leaching | Selective Leaching of Materials | | |
| 3 | 3.2.1-43 | Gray cast iron piping, piping components, and piping elements exposed to soil | Loss of material due to selective leaching | Selective Leaching of Materials | | |
| 4 | 3.2.1-44 | Gray cast iron motor cooler exposed to treated water | Loss of material due to selective leaching | Selective Leaching of Materials | | |
| 5 | 3.2.1-50 | Aluminum piping, piping components, and piping elements exposed to air - indoor uncontrolled (internal/external) | None | None | | |
| 6 | 3.2.1-51 | Galvanized steel ducting exposed to air - indoor controlled (external) | None | None | | |
| 7 | 3.2.1-52 | Glass piping elements exposed to air - indoor uncontrolled (external), lubricating oil, raw water, treated water, or treated borated water | None | None | | |

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.2.1-53 | Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) | None | None | | |
| 3.2.1-54 | Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) | None | None | | |
| 3.2.1-55 | Steel and stainless steel piping, piping components, and piping elements in concrete | None | None | | |
| 3.2.1-56 | Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to gas | None | None | | |



### 3.2.2.1 AMR Results That Are Consistent with The GALL Report

Summary of Information in the Application

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 PNPS LRA is acceptable.

In PNPS LRA Section 3.2.2.1, the applicant identifies the materials, environments, and aging effects requiring management. The applicant identifies the following programs that manage the aging effects related to the residual heat removal system, core spray system, automatic depressurization system, high pressure coolant injection system, reactor core isolation cooling system, standby gas treatment system, and primary containment penetrations components and component groups:

- Buried Piping and Tanks Inspection Program (B.1.2)
- Containment Leak Rate Program (B.1.9)
- Flow-Accelerated Corrosion Program (B.1.14)

- Heat Exchanger Monitoring Program (B.1.15)
- Instrument Air Quality Program (B.1.17)
- Oil Analysis Program (B.1.22)
- One-Time Inspection Program (B.1.23)
- Periodic Surveillance and Preventive Maintenance Program (B.1.24)
- Selective Leaching Program (B.1.27)
- System Walkdown Program (B.1.30)
- Water Chemistry Control – BWR Program (B.1.32.2)
- Water Chemistry Control – Closed Cooling Water (B.1.32.3)

<u>Project Team Evaluation</u>

The project team reviewed its assigned PNPS LRA AMR 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 system, core spray system, automatic depressurization system, high pressure coolant injection system, reactor core isolation cooling system, standby gas treatment system, and primary containment penetrations components and component groups that are subject to an AMR.

[This section addresses consistency with the GALL Report. For each Tables 1 entry for which no further evaluation is required by the SRP-LR and the project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicant's basis for why it is acceptable. Identify documents reviewed, full title, revision, and/or date of issue, and the reviewer's basis for accepting the differences. If additional information is requested from the applicant to develop an acceptable reviewer finding, cite the applicant's docketed letter, commitment or other docketed LRA supplement. The docketed item is to be cited by title, date and ADAMs accession number. Use Template 5 below for this purpose. There is to be a separate, numbered section for each aging effect in Table 1 that is to be discussed. Otherwise, there is no need to discuss that particular Table 1 entry]

[This section also addresses Table 2 regarding consistency with the GALL Report when project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicants basis for why it is acceptable (for example, a different Note is used). This section also addresses Note E and why using an AMP that is different than that recommended in GALL Report is acceptable (see Example 13 at the end of this document)]

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**Template 5 - <u>Aging Management Reviews Results that Are Consistent with the GALL Report – with Identified Difference/Issue</u>**

3.[Y].2.1.S] <u>Title of Aging Effect/Mechanism</u>

In the discussion section of Table 3.Y.1, Item [NUMBER] of the PNPS LRA, the applicant stated that [provide description of in the LRA]. During the audit and review, the project team noted that [provide description of differences, the applicant's basis.]

[Identify documents reviewed and basis for acceptability, project team evaluation]

On the basis of its review, the project team found that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

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Conclusion

The project team has evaluated the applicant's claim of consistency with the GALL Report. The project team also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the project team found that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team found that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).



### 3.2.2.2 AMR Results For Which Further Evaluation Is Recommended By The GALL Report

Summary of Information in the Application

In PNPS LRA Section 3.2.2.2, the applicant provides further evaluation of aging management as recommended by the GALL Report for the aging effects related to the residual heat removal system, core spray system, automatic depressurization system, high pressure coolant injection system, reactor core isolation cooling system, standby gas treatment system, and primary containment penetrations components and component groups. The applicant also provided information concerning how it will manage the related aging effects.

Project Team Evaluation

For some AMR line-items assigned to the project team in the PNPS LRA Tables 3.2.1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNPS LRA Section 3.2.2.2 against the criteria provided in the SRP-LR Section 3.2.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 AMR line-item in Section 3.2 citing the item in Table 1.

3.2.2.2.1 Cumulative Fatigue Damage

In the PNPS LRA Section 3.2.2.2.1, the applicant states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). The project team's evaluation of this TLAA is addressed separately in Section 4 of the SER related to the PNPS LRA.

3.2.2.2.2 Loss of Material due to General Corrosion

The project team reviewed PNPS LRA Section 3.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.

The SRP-LR Section 3.2.2.2.2 states that the loss of material due to cladding breach could occur for PWR steel pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks, and recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In the PNPS LRA Section 3.2.2.2.2, the applicant states that this item covers underclad cracking of cladding on PWR steel pump casings. Because PNPS is a BWR and does not have charging pumps or steel pump casings with stainless steel cladding, this item is not applicable to PNPS.

The project team found that this section is not applicable to PNPS.



3.2.2.2.3 Loss of Material due to Pitting and Crevice Corrosion

3.2.2.2.3.1 Loss of Material due to Pitting and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.2.2.2.3.1 against the criteria in SRP-LR Section 3.2.2.2.3.1.

The SRP-LR Section 3.2.2.2.3.1 states that the loss of material due to pitting and crevice corrosion could occur for internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry to mitigate degradation. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion 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 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 the PNPS LRA Section 3.2.2.2.3.1, the applicant states that the loss of material due to pitting and crevice corrosion for internal surfaces of stainless steel piping and components in ESF systems exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control-BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components including areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found 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 found 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).

3.2.2.2.3.2 <u>Loss of Material due to Pitting and Crevice Corrosion [Item 2]</u>

The project team reviewed PNPS LRA Section 3.2.2.2.3.2 against the criteria in SRP-LR Section 3.2.2.2.3.2.

The SRP-LR Section 3.2.2.2.3.2 states that the loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

In the PNPS LRA Section 3.2.2.2.3.2, the applicant states that, at PNPS, there are no stainless steel ESF components that are in contact with a soil environment. Therefore, this item is not applicable.



The project team determined that this item is not applicable to PNPS.

3.2.2.2.3.3 <u>Loss of Material due to Pitting and Crevice Corrosion [Item 3]</u>

The project team reviewed PNPS LRA Section 3.2.2.2.3.3 against the criteria in SRP-LR Section 3.2.2.2.3.3.

SRP-LR Section 3.2.2.2.3.3 states that the loss of material from pitting and crevice corrosion could occur for BWR stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry for BWRs to mitigate degradation. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations 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 verify the effectiveness of the water 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 the PNPS LRA Section 3.2.2.2.3.3, the applicant states that the loss of material from pitting and crevice corrosion for BWR stainless steel piping and piping components exposed to treated water at PNPS is managed by the Water Chemistry Control– BWR Program. ESF systems at PNPS do not contain any components made of aluminum. The effectiveness of the Water Chemistry Control-BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.3 for further evaluation. The project team found 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).

3.2.2.2.3.4 <u>Loss of Material due to Pitting and Crevice Corrosion [Item 4]</u>

The project team reviewed PNPS LRA Section 3.2.2.2.3.4 against the criteria in SRP-LR Section 3.2.2.2.3.4.

SRP-LR Section 3.2.2.2.3.4 states that the loss of material from pitting and crevice corrosion could occur for stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.2.2.2.3.4, the applicant states that the loss of material is managed by the Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.4 for further evaluation. The project team found 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).

3.2.2.2.3.5 <u>Loss of Material due to Pitting and Crevice Corrosion [Item 5]</u>

The project team reviewed PNPS LRA Section 3.2.2.2.3.5 against the criteria in SRP-LR Section 3.2.2.2.3.5.

SRP-LR Section 3.2.2.2.3.5 states that the loss of material from pitting and crevice corrosion could occur for of partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

In the PNPS LRA Section 3.2.2.2.3.5, the applicant states that, at PNPS, there are no outdoor stainless steel tanks in ESF systems. This item is therefore not applicable.

The project team found that this item is not applicable to PNPS.

3.2.2.2.3.6 Loss of Material due to Pitting and Crevice Corrosion [Item 6]

The project team reviewed PNPS LRA Section 3.2.2.2.3.6 against the criteria in SRP-LR Section 3.2.2.2.3.6.

The SRP-LR Section 3.2.2.2.3.6 states that the loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

In the PNPS LRA Section 3.2.2.2.3.6, the applicant states that, at PNPS, there are no components in ESF systems that are exposed to internal condensation. This item is therefore not applicable.

The project team found that this item is not applicable to PNPS.

3.2.2.2.4 Loss of Material Due to General, Pitting, and Microbiologically Influenced Corrosion

3.2.2.2.4.1 Loss of Material Due to General, Pitting, and Microbiologically Influenced Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.2.2.2.4.1 against the criteria in SRP-LR Section 3.2.2.2.4.1.

The SRP-LR Section 3.2.2.2.4.1 states that the reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing AMP relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil chemistry may not always have been adequate to preclude fouling. Therefore, the effectiveness of lube oil chemistry control should be verified to ensure that fouling is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control. 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 the PNPS LRA Section 3.2.2.2.4.1, the applicant states that the reduction of heat transfer due to fouling for stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil in ESF systems is managed by the Oil Analysis Program at PNPS. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to fouling. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that fouling has not and will not affect the intended functions of these components.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.4.1 for further evaluation. The project team found 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).

3.2.2.2.4.2 Loss of Material Due to General, Pitting, and Microbiologically Influenced Corrosion [Item 2]



The project team reviewed PNPS LRA Section 3.2.2.2.4.2 against the criteria in SRP-LR Section 3.2.2.2.4.2.

The SRP-LR Section 3.2.2.2.4.2 states that the reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water. The existing program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may have been inadequate. Therefore, the GALL report recommends that the effectiveness of the chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.2.2.2.4.2, the applicant states that the reduction of heat transfer due to fouling for stainless steel heat exchanger tubes exposed to treated water in ESF systems at PNPS is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control-BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.4.2 for further evaluation. The project team found 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).

3.2.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The project team reviewed PNPS LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5.

The SRP-LR Section 3.2.2.2.5 states that hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components associated with the BWR Standby Gas Treatment System ductwork and filters exposed to air-indoor uncontrolled. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

In the PNPS LRA Section 3.2.2.2.5, the applicant states that the Periodic Surveillance and Preventive Maintenance Program manages aging in elastomer components of the standby gas treatment system exposed to air. The program includes periodic visual or other nondestructive inspections and manipulations to manage cracking and changes in material properties.

[Identify documents reviewed and basis for acceptability, project team evaluation]



The project team found 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 found 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).

3.2.2.2.6 Loss of Material Due to Erosion

The project team reviewed PNPS LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6.

SRP-LR Section 3.2.2.2.6 states that the loss of material due to erosion could occur in the stainless steel high pressure safety injection (HPSI) pump miniflow recirculation orifice exposed to treated borated water. The GALL Report recommends a plant-specific AMP be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. The GALL Report references Licensee Event Report (LER) 50-275/94-023 for evidence of erosion. Further evaluation is recommended to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

In the PNPS LRA Section 3.2.2.2.6, the applicant states that the discussion refers to stainless steel high pressure safety injection (HPSI) pump miniflow recirculation orifice exposed to treated borated water. PNPS is a BWR and has no HPSI pump miniflow orifice and as such this item is not applicable.

The project team found that this item is not applicable to PNPS.

3.2.2.2.7 General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling

The project team reviewed PNPS LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7.

SRP-LR Section 3.2.2.2.7 states that the loss of material due to general corrosion and fouling can occur for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to uncontrolled indoor air. This could result in plugging of the spray nozzles and flow orifices. This aging mechanism and effect will apply since the spray nozzles and flow orifices are occasionally wetted, even though the majority of the time this system is on standby. The wetting and drying of these components can accelerate corrosion and fouling. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

In the PNPS LRA Section 3.2.2.2.7, the applicant states that this item refers to loss of material due to general corrosion and fouling occurring for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to uncontrolled indoor air. At PNPS the spray nozzles are copper alloy and stainless steel and are not subject to loss of material due to general corrosion in an indoor air environment. There are also no orifices in ECCS systems exposed to an indoor air environment (internal).



[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found 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 found 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).

3.2.2.2.8 Loss of Material Due to General, Pitting and Crevice Corrosion

3.2.2.2.8.1 Loss of Material Due to General, Pitting and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.2.2.2.8.1 against the criteria in SRP-LR Section 3.2.2.2.8.1.

The SRP-LR Section 3.2.2.2.8.1 states that the loss of material due to general, pitting and crevice corrosion could occur for BWR steel piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry) for BWRs to mitigate degradation. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations 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 verify the effectiveness of the water 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 the PNPS LRA Section 3.2.2.2.8.1, the applicant states that the loss of material due to general, pitting and crevice corrosion for BWR steel piping and components in ESF systems exposed to treated water is managed at PNPS by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control-BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow. The Periodic Surveillance and Preventive Maintenance Program will also be used to manage loss of material for ADS system piping wetted in the waterline region of the torus.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.8.1 for further evaluation. The project team found 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).

3.2.2.2.8.2 Loss of Material Due to General, Pitting and Crevice Corrosion [Item 2]



The project team reviewed PNPS LRA Section 3.2.2.2.8.2 against the criteria in SRP-LR Section 3.2.2.2.8.2.

The SRP-LR Section 3.2.2.2.8.2 states that the loss of material due to general, pitting, and crevice corrosion could occur for the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry to mitigate degradation. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs 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 such that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.2.2.2.8.2, the applicant states that steel containment isolation components exposed to treated water are all part of other safety systems that are evaluated separately. Section 3.2.2.2.8.1 above describes the detection of aging effects in these components. As stated above, the loss of material due to general, pitting and crevice corrosion for internal surfaces of primary containment penetrations steel piping and components exposed to treated water is managed at PNPS by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control-BWR Program will be confirmed by the One-Time

Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.8.2 for further evaluation. The project team found 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).

3.2.2.2.8.3 Loss of Material Due to General, Pitting and Crevice Corrosion [Item 3]

The project team reviewed PNPS LRA Section 3.2.2.2.8.3 against the criteria in SRP-LR Section 3.2.2.2.8.3.

The SRP-LR Section 3.2.2.2.8.3 states that the loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.2.2.2.8.3, the applicant states that the loss of material due to general, pitting and crevice corrosion for steel piping and components in ESF systems exposed to lubricating oil is managed by the Oil Analysis Program. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.8.3 for further evaluation. The project team found 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).

3.2.2.2.9 Loss of Material Due to General Corrosion and Fouling

The project team reviewed PNPS LRA Section 3.2.2.2.9 against the criteria in SRP-LR Section 3.2.2.2.9.

The SRP-LR Section 3.2.2.2.9 states that the loss of material due to general, pitting, crevice, and MIC could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

In the PNPS LRA Section 3.2.2.2.9, the applicant states that the loss of material due to general, pitting, crevice, and MIC for steel (with or without coating or wrapping) piping and piping components buried in soil in ESF systems at PNPS is managed by the Buried Piping and Tanks Inspection Program. This program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel components. Buried components will be inspected when excavated during maintenance. An inspection will be performed within ten years of entering the period of extended operation, unless an opportunistic inspection occurred within this ten-year period.

[Identify documents reviewed and basis for acceptability, project team evaluation]



The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.9 for further evaluation. The project team found 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).

3.2.2.2.10 <u>Quality Assurance for Aging Management of Nonsafety-Related Components</u>

The SRP-LR Section 3.2.2.2.10 states that the acceptance criteria for the quality assurance program, procedures, and administrative controls are described in Branch Technical Position IQMB-1 (Appendix A.2 of the SRP-LR.)

In PNPS LRA Section 3.2.2.2.10 the applicant states that the quality assurance program, procedures, and administrative controls are discussed in Appendix B Section B.0.3.

<u>Conclusion</u>

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 determined that the applicant adequately addressed the issues that were further evaluated. The project team found 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).

### 3.2.2.3 AMR Results That Are Not Consistent With The GALL Report Or Not Addressed In The GALL Report

<u>Summary of Information in the Application</u>

In PNPS LRA Table 3.2.1, "Summary of Aging Management Evaluations for the Engineered Safety Features Evaluated in Chapter V of NUREG 1801," the applicant provided information regarding components or material/environment combination in the GALL Report that it evaluated and identified as not applicable to its plant.

In PNPS LRA Tables 3.2.2-1 through 3.2.2-7, the applicant provided additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report. Specifically, the applicant indicated, via Notes F through J, that neither the identified component nor the material and/or environment combination is evaluated in the GALL Report and provided information concerning how the aging effect requiring management will be managed.

<u>Project Team Evaluation</u>

The project team reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.



<u>Aging Effect/Mechanism in Table 3.2.1 That Are Not Applicable for PNPS</u>

[This section is for write-up of the AMR line-items that the applicant claims are not used or not applicable to its plant in LRA Table 1. The write-up does not include the "further evaluation required" in Table 1 since they are evaluated in Section 3.[Y].2. In addition, the evaluation is not necessary if the plant is of a different vintage (PWR vs. BWR)]

The project team reviewed PNPS LRA Table 3.2.1, which provides a summary of aging management evaluations for the engineered safety features evaluated in the GALL Report.

In PNPS LRA Table 3.2.1, Item 3.2.1-4 discussion column, the applicant states that the loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, and piping elements exposed to soil is not applicable to PNPS because no stainless steel components in the EFS systems are exposed to soil.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-7 discussion column, the applicant states that the loss of material due to pitting and crevice corrosion of partially encased stainless steel tanks with breached moisture barrier exposed to raw water is not applicable to PNPS because there are no outdoor tanks in the ESF systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-8 discussion column, the applicant states that the loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, piping elements, and tak internal surfaces exposed to condensation (internal )is not applicable to PNPS because no there are no internal stainless steel surfaces exposed to condensation in the ESF systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-13 discussion column, the applicant states that the loss of material due to general corrosion and fouling of steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to uncontrolled indoor air is not applicable to PNPS because there are no steel nozzles or flow orifices internally exposed to air in the drywell and suppression chamber spray flow paths.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-15 discussion column, the applicant states that the loss of material due to general, pitting, and crevice corrosion of steel containment isolation piping, piping containment, and piping elements internal surfaces exposed to treated water is not applicable to PNPS because steel containment isolation components exposed to treated water are all part of other safety systems that are evaluated separately. .

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-20 discussion column, the applicant states that the loss of fracture toughness due to thermal aging embrittlement of cast austenitic stainless steel (CASS) piping, piping components, and piping elements exposed to treated water (borated or unborated) in excess of 250°C (>482°F) is not applicable because there are no CASS components in the ESF systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA, Table 3.2.1, Item 3.2.1-21 discussion column the applicant states that cracking due to cycling loading, stress corrosion cracking for high-strength steel closure bolting exposed to air with steam or water leakage is not applicable at PNPS because high strength steel closure bolting is not used in ESF systems at PNPS

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA, Table 3.2.1, Item 3.2.1-22 discussion column the applicant states that the loss of material due to general, pitting, and crevice corrosion of steel bolting and closure bolting exposed to uncontrolled indoor or outdoor air is not applicable to PNPS because all steel closure bolting exposed to external air is conservatively assumed to be exposed to uncontrolled indoor air.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA, Table 3.2.1, Item 3.2.1-24 discussion column the applicant states that the loss of preload due to thermal effects, gasket creep, and self loosening of steel closure bolting exposed to uncontrolled internal or external air is not applicable to PNPS for the following reasons:

- The loss of preload is a design driven effect and not an aging effect requiring management.
- Bolting at PNPS is standard ASTM grade B7 carbon steel, or similar material, except in rare specialized applications such as applications where stainless steel bolting is utilized.
- Loss of preload due to stress relaxation (creep) would only be a concern in very high temperature applications (> 700°F) as stated in the ASME Code, Section II, Part D, Table 4.

- No PNPS bolting operates at >700°F. Therefore, loss of preload due to stress relaxation (creep) is not an applicable aging effect for ESF systems.
- Other issues that may result in pressure boundary joint leakage are improper design or maintenance issues.
- Improper bolting application (design) and maintenance issues are current plant operational concerns and not related to aging effects or mechanisms that require management during the period of extended operation.
- To address these bolting operational concerns, PNPS has taken actions to address NUREG–1339,

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-26 discussion column, the applicant states that the loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to closed cycle cooling water is not applicable to PNPS because steel containment isolation components exposed to closed cycle cooling water are all part of other safety systems that are evaluated separately.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-33 discussion column, the applicant states that the loss of material due to general, pitting, and crevice corrosion of steel encapsulation components exposed to uncontrolled indoor air is not applicable at PNPS because the ESF systems include no steel encapsulation components.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-36 discussion column, the applicant states that the loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling of steel heat exchanger components exposed to raw water is not applicable to PNPS because there are no steel heat exchanger components exposed to raw water in the ESF systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-37 discussion column, the applicant states that the loss of material due to pitting, crevice, and microbiologically-influenced corrosion of stainless steel piping, piping componets, and piping elements exposed to raw water is not applicable to PNPS because there are no stainless steel components exposed to raw water in the ESF systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-38 discussion column, the applicant states that the loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling of stainless steel components internal surfaces exposed to raw water is not applicable to PNPS because there are no stainless steel components exposed to raw water in the ESF systems.



[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-39 discussion column, the applicant states that the loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling of stainless steel heat exchanger components exposed to raw water is not applicable to PNPS because there are no stainless steel heat exchanger components exposed to raw water in the ESF systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-40 discussion column, the applicant states that the reduction of heat transfer due to fouling of steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water is not applicable to PNPS because there are no steel or stainless steel heat exchanger tubes exposed to raw water in the ESF systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-42 discussion column, the applicant states that the loss of material due to selective leaching of gray cast iron piping, piping components, and piping elements exposed to closed cycle cooling water is not applicable to PNPS because there are no grey cast iron components exposed to closed cycle cooling water in the ESF system.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-43 discussion column, the applicant states that the loss of material due to selective leaching of gray cast iron piping, piping components, and piping elements exposed to soil is not applicable to PNPS because there are no grey cast iron components exposed to soil in the ESF system.

[The project team evaluation, if applicable]



On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-50 discussion column, the applicant states that the aging of aluminum piping, piping components, and piping elements exposed to uncontrolled internal or external air is not applicable to PNPS because there are no aluminum components in the ESF system.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-51 discussion column, the applicant states that aging of galvanized steel ducting exposed to controlled indoor air is not applicable to PNPS because galvanized steel surfaces are evaluated as steel for the ESF systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-54discussion column, the applicant states that aging of steel piping, piping components, and piping elements exposed to indoor controlled air is not applicable to PNPS because there are no steel components of the ESF systems in indoor controlled air environments. All indoor air environments are conservatively considered to be uncontrolled.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.2.1, Item 3.2.1-55discussion column, the applicant states that aging of steel and stainless steel piping, piping components, and piping elements in concrete is not applicable to PNPS because there are no steel or stainless steel components of the ESF system embedded in concrete.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the engineered safety features at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.



[Repeat the above three paragraphs, if applicable, for all items that the applicant claims are not applicable to its plant]

[If there are RAIs or issues that affect all Tables, provide discussion and evaluation here]

[If the LRA lists a series of components which have no aging effect and therefore do not require aging management, the following writeup may be used, as appropriate.]

<u>Engineered Safety Features AMR Line Items That Have No Aging Effect (PNPS LRA Tables 3.2.2-1 through 3.2.2-7)</u>

In LRA Tables 3.2.2-1 through 3.2.2-7, the applicant identified AMR line-items where no aging effects were identified as a result of its aging review process. Specific instances in which the applicant states that no aging effects were identified occurred for the following components, fabrication materials, and environments.

- Components fabricated from stainless steel used for tubing, thermowells, duct work, and orifices that are and exposed to an indoor air environment require no AMR. The environment is not in the GALL Report for this component and this material.

On the basis of its review of current industry research and operating experience, the project team found that and indoor air environment on stainless steel tubing, thermowells, ductwork, and orifices will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for stainless steel components exposed to and indoor air environment.

- Components fabricated from copper alloy (>15% zinc) used for valve bodies and tubing and exposed to an indoor air environment require no AMR. The environment is not in the GALL Report for this component and this material.

On the basis of its review of current industry research and operating experience, the project team found that an indoor air environment on valve bodies and tubing fabricated from a copper alloy (>15% zinc) will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for components fabricated for copper alloy (>15% zinc) exposed to and indoor air environment.

3.2.2.3.1 <u>Residual Heat Removal System (RHR) - Summary of Aging Management Evaluation - PNPS LRA Table 3.2.2-1</u>

The Project Team reviewed the PNPS LRA Table 3.2.2-1 which summarizes the results of AMR evaluations for the residual heat removal component groups.

In the PNPS LRA Table 3.2.2-1 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].



The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.2.2-1 titled "Residual Heat Removal System (RHR) - Summary of Aging Management Evaluation is acceptable.

3.2.2.3.2 <u>Core Spray System (CS) - Summary of Aging Management Evaluation - PNPS LRA Table 3.2.2-2</u>

The Project Team reviewed the PNPS LRA Table 3.2.2-2 which summarizes the results of AMR evaluations for the core spray system component groups.

In the PNPS LRA Table 3.2.2-1 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].

The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.2.2-2 titled "Core Spray System (CS) - Summary of Aging Management Evaluation is acceptable.

3.2.2.3.3 Automatic Depressurization System (ADS) - Summary of Aging Management Evaluation - PNPS LRA Table 3.2.2-3

The Project Team reviewed the PNPS LRA Table 3.2.2-3 which summarizes the results of AMR evaluations for the automatic depressurization system component groups.

In the PNPS LRA Table 3.2.2-3 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].

The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.2.2-3 titled "Automatic Depressurization System (ADS) - Summary of Aging Management Evaluation is acceptable.



3.2.2.3.4 High Pressure Coolant Injection System (HPCI) - Summary of Aging Management Evaluation - PNPS LRA Table 3.2.2-4

The Project Team reviewed the PNPS LRA Table 3.2.2-4 which summarizes the results of AMR evaluations for the high pressure coolant injection system component groups.

In the PNPS LRA Table 3.2.2-4 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].

The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.2.2-4 titled "High Pressure Coolant Injection System - Summary of Aging Management Evaluation is acceptable.

3.2.2.3.5 Reactor Core Isolation Cooling System (RCIC) - Summary of Aging Management Evaluation - PNPS LRA Table 3.2.2-5

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The Project Team reviewed the PNPS LRA Table 3.2.2-5 which summarizes the results of AMR evaluations for the residual heat removal component groups.

In the PNPS LRA Table 3.2.2-5 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].

The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.2.2-5 titled "Reactor Core Isolation Cooling System (RCIC) - Summary of Aging Management Evaluation is acceptable.

In the PNPS LRA Table 3.2.2-5 the applicant proposed to manage the loss of material due to wear of copper alloy (>15% zinc) for the heat exchanger tubes exposed to lube environment using PNPS AMP number B.1.15 titled Heat Exchanger Monitoring Program.

The Project Team reviewed the heat exchanger monitoring program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of loss of material due to wear of copper alloy (>15% zinc) heat exchanger tubes exposed to a lubricating oil environment are effectively managed using the heat exchanger monitoring program. On this basis, the project team found that management of the loss of material due to wear in PNPS LRA Table 3.2.2-5 titled "Reactor Core Isolation Cooling System (RCIC) - Summary of Aging Management Evaluation is acceptable.

In the PNPS LRA Table 3.2.2-5 the applicant proposed to manage [list aging effect] of [list materials] for the [component types] exposed to [list environment] environment using PNPS AMP [AMP Number] titled [AMP Name].

The Project Team reviewed [AMP Name] program and the evaluation is documented in Section [3.0.3.A.A.] of this audit report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in PNPS LRA Table 3.2.2-5 titled "Reactor Core Isolation Cooling System (RCIC) - Summary of Aging Management Evaluation is acceptable.

On the basis of its audit and review of the applicant's program, the project team found 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, the project team found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not addressed in the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.2.3 Conclusion

On the basis of its review, the project team concluded that the applicant has demonstrated that the aging effects associated with the engineered safety features components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable UFSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the engineered safety features components, as required by 10 CFR 54.21(d).

## 3.3 Aging Managementof Auxiliary Systems

This section of the audit and review report document the project team's review and evaluation of PNPS aging management review (AMR) results for those components in the auxiliary systems. The following systems are addressed in this section:

- standby liquid control system
- salt service water system
- reactor building closed cooling water system
- emergency diesel generator system
- station blackout diesel generator system
- security diesel
- fuel oil system
- instrument air system
- fire protection — water system
- fire protection — halon system
- heating, ventilation and air conditioning systems
- primary containment atmosphere control
- fuel pool cooling and fuel handling and storage systems
- miscellaneous systems in scope for 10 CFR 54.4(a)(2)

### 3.3.1 Summary of Technical Information in the Application



In the PNPS LRA Section 3.3, the applicant provides the results of its AMRs for the auxiliary systems components and component groups.

In PNPS LRA Table 3.3.1, "Summary of Aging Management Evaluations for the Auxiliary Systems Evaluated in Chapter VII of NUREG-1801," the applicant provides a summary comparison of its AMR line-items with the AMR line-items evaluated in the GALL Report for the auxiliary systems components and component groups. The applicant also identifies for each component type in the PNPS LRA Table 3.3.1 those components that are consistent with the GALL Report, those for 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.

In the PNPS LRA Tables 3.3.2-1 through 3.3.2-14-35, the applicant provided a summary of the AMR results for component types associated with the following auxiliary systems:

- Standby Liquid Control (SLC) System
- SSW Systems
- Reactor Building Closed Cooling Water (RBCCW) System
- Emergency Diesel Generator (EDG) System
- Station Blackout Diesel (SBO) System
- Security Diesel
- Fuel Oil (FO) System
- Instrument Air (IA) System
- Fire Protection — Water System

- Fire Protection — Halon System
- Heating, Ventilation and Air Conditioning (HVAC) Systems
- Primary Containment Atmosphere Control (PCAC) Systems
- Fuel Pool Cooling (FPC) and Fuel Handling and Storage Systems

Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Tables 3.3.2-14-1 to 3.3.2-14-35)

- Circulating Water System, Nonsafety-Related Components Affecting Safety-Related Systems (CWS)

- Compressed Air System, Nonsafety-Related Components Affecting Safety-Related Systems (CAS)

- Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems

- Condensate Demineralizer (CDS), Nonsafety-Related Components Affecting Safety-Related Systems

- Condensate Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems

- Control Rod Drive (CRD) System, Nonsafety-Related Components Affecting Safety-Related Systems



- Core Spray (CS) System, Nonsafety-Related Components Affecting Safety-Related Systems

- Emergency Diesel Generator (EDG) System, Nonsafety-Related Components Affecting Safety-Related Systems

- Extraction Steam System, Nonsafety-Related Components Affecting Safety-Related Systems

- Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems

- Feedwater Heater Drains and Vents System, Nonsafety-Related Components Affecting Safety-Related Systems

- Fire Protection System, Nonsafety-Related Components Affecting Safety-Related Systems

- Fuel Oil (FO) Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems

- Fuel Pool Cooling (FPC) and Demineralizer System, Nonsafety-Related Components Affecting Safety-Related Systems

- Heating, Ventilation and Air Conditioning (HVAC) Systems, Nonsafety-Related Components Affecting Safety-Related Systems
- High Pressure Coolant Injection (HPCI) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Main Condenser, Nonsafety-Related Components Affecting Safety-Related Systems
- Main Steam (MS) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Offgas and Augmented Offgas (AOG) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Post-Accident Sampling (PASS) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Potable and Sanitary Water System, Nonsafety-Related Components Affecting Safety-Related Systems
- Primary Containment Atmospheric Control (PCAC) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Radioactive Waste System, Nonsafety-Related Components Affecting Safety-Related Systems
- Reactor Building Closed Cooling Water (RBCCW) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Reactor Core Isolation Cooling (RCIC) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Reactor Coolant (RCS) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Reactor Water Cleanup (RWCU) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Residual Heat Removal (RHR) System, Nonsafety-Related Components Affecting Safety-Related Systems
- SSW System, Nonsafety-Related Components Affecting Safety-Related Systems
- Sampling Systems, Nonsafety-Related Components Affecting Safety-Related Systems
- Sanitary Soiled Waste and Vent; Plumbing and Drains, Nonsafety-Related Components Affecting Safety-Related Systems

- Screen Wash System, Nonsafety-Related Components Affecting Safety-Related Systems
- Standby Liquid Control (SLC) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Turbine Building Closed Cooling Water (TBCCW) System, Nonsafety-Related Components Affecting Safety-Related Systems
- Turbine Generator and Auxiliaries, Nonsafety-Related Components Affecting Safety-Related Systems

Specifically, the information for each component type includes intended function, material, environment, aging effect requiring management, AMPs, the GALL Report Volume 2 item, cross reference to the PNPS LRA Table 3.3.1 (Table 1), and generic and plant-specific notes related to consistency with the GALL Report.

The applicant's AMRs incorporates applicable operating experience in the determination of aging effect requiring managements (AERMs). These reviews include evaluation of plant-specific and industry operating experience. The plant-specific evaluation include reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience includes a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.



### 3.3.2 Project Team Evaluation

The project team reviewed PNPS LRA Section 3.3 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team reviewed certain identified AMR line-items to confirm the applicant's claim that these AMR line-items were consistent with the GALL Report. The project team did not repeat its review of the matters described in the GALL Report. However, the project team did verify that the material presented in the PNPS LRA was applicable and that the applicant had identified the appropriate GALL Report AMR line-items. The project team's audit evaluation is documented in Section 3.3.2.1 of this audit and review report. In addition, the project team's evaluations of the AMPs are documented in Section 3.0.3 of this audit and review report.

The project team reviewed those selected AMR line-items for which further evaluation is recommended by the GALL Report. The project team confirmed that the applicant's further evaluations were in accordance with the acceptance criteria in SRP-LR. The project team's audit evaluation is documented in Section 3.3.2.2 of this audit and review report.

The project team also reviewed of the remaining AMR line-items that were not consistent with or not addressed in the GALL Report based on NRC-approved precedents. The audit included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The project team's evaluation is documented in Section 3.3.2.3 of this audit and review report.

Finally, the project team reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the auxiliary systems.

Table 3.3-1 below provides a summary of the project team's evaluation of components, aging effects/aging mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report. It also includes the section of the audit and review report in which the project team's evaluation is documented.

**Table 3.3-1 Staff Evaluation for Auxiliary Systems Components in the GALL Report**

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.3.1-1 | Steel cranes - structural girders exposed to air - indoor uncontrolled (external) | Cumulative fatigue damage | TLAA to be evaluated for structural girders of cranes. See the Standard Review Plan, Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1). | | |
| 3.3.1-2 | Steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air - indoor uncontrolled, treated borated water or treated water | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | | |
| 3.3.1-3 | Stainless steel heat exchanger tubes exposed to treated water | Reduction of heat transfer due to fouling | Water Chemistry and One-Time Inspection | | |
| 3.3.1-4 | Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution > 60°C (> 140°F) | Cracking due to stress corrosion cracking | Water Chemistry and One-Time Inspection | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-5 | Stainless steel and stainless clad steel heat exchanger components exposed to treated water > 60°C (> 140°F) | Cracking due to stress corrosion cracking | A plant specific aging management program is to be evaluated. | | |
| 2 | 3.3.1-6 | Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust | Cracking due to stress corrosion cracking | A plant specific aging management program is to be evaluated. | | |
| 3 | 3.3.1-7 | PWR Only | | | | |
| 4 | 3.3.1-8 | PWR Only | | | | |
| 5 | 3.3.1-9 | PWR Only | | | | |
| 6 | 3.3.1-10 | High-strength steel closure bolting exposed to air with steam or water leakage. | Cracking due to stress corrosion cracking, cyclic loading | Bolting Integrity The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance. | | |
| 7 | 3.3.1-11 | Elastomer seals and components exposed to air - indoor uncontrolled (internal/external) | Hardening and loss of strength due to elastomer degradation | A plant specific aging management program is to be evaluated | | |
| 8 | 3.3.1-12 | Elastomer lining exposed to treated water or treated borated water | Hardening and loss of strength due to elastomer degradation | A plant-specific aging management program is to be evaluated. | | |
| 9 | 3.3.1-13 | Boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water | Reduction of neutron-absorbing capacity and loss of material due to general corrosion | A plant specific aging management program is to be evaluated | | |
| 10 | 3.3.1-14 | Steel piping, piping component, and piping elements exposed to lubricating oil | Loss of material due to general, pitting, and crevice corrosion | Lubricating Oil Analysis and One-Time Inspection | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-15 | Steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil | Loss of material due to general, pitting, and crevice corrosion | Lubricating Oil Analysis and One-Time Inspection | | |
| 2 | 3.3.1-16 | Steel reactor coolant pump oil collection system tank exposed to lubricating oil | Loss of material due to general, pitting, and crevice corrosion | Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank | | |
| 3 | 3.3.1-17 | Steel piping, piping components, and piping elements exposed to treated water | Loss of material due to general, pitting, and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 4 | 3.3.1-18 | Stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust | Loss of material/general (steel only), pitting and crevice corrosion | A plant specific aging management program is to be evaluated | | |
| 5 | 3.3.1-19 | Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil | Loss of material due to general, pitting, crevice, and micro biologically influenced corrosion | Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection | | |
| 6 | 3.3.1-20 | Steel piping, piping components, piping elements, and tanks exposed to fuel oil | Loss of material due to general, pitting, crevice, and micro biologically influenced corrosion, and fouling | Fuel Oil Chemistry and One-Time Inspection | | |
| 7 | 3.3.1-21 | Steel heat exchanger components exposed to lubricating oil | Loss of material due to general, pitting, crevice, and micro biologically influenced corrosion, and fouling | Lubricating Oil Analysis and One-Time Inspection | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-22 | Steel with elastomer lining or stainless steel cladding piping, piping components , and piping elements exposed to treated water and treated borated water | Loss of material due to pitting and crevice corrosion (only for steel after lining/cladding degradation) | Water Chemistry and One-Time Inspection | | |
| 2 | 3.3.1-23 | Stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 3 | 3.3.1-24 | Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 4 | 3.3.1-25 | Copper alloy HVAC piping, piping components , piping elements exposed to condensation (external) | Loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated. | | |
| 5 | 3.3.1-26 | Copper alloy piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to pitting and crevice corrosion | Lubricating Oil Analysis and One-Time Inspection | | |
| 6 | 3.3.1-27 | Stainless steel HVAC ducting and aluminum HVAC piping, piping components and piping elements exposed to condensation | Loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated. | | |
| 7 | 3.3.1-28 | Copper alloy fire protection piping, piping components, and piping elements exposed to condensation (internal) | Loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated. | | |
| 8 | 3.3.1-29 | Stainless steel piping, piping components, and piping elements exposed to soil | Loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated. | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-30 | Stainless steel piping, piping components, and piping elements exposed to sodium pentabo rate solution | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 2 | 3.3.1-31 | Copper alloy piping, piping components, and piping elements exposed to treated water | Loss of material due to pitting, crevice, and galvanic corro sion | Water Chemistry and One-Time Inspection | | |
| 3 | 3.3.1-32 | Stainless steel, aluminum and copper alloy piping, piping components , and piping elements exposed to fuel oil | Loss of material due to pitting, crevice, and microbiologic ally influenced corrosion | Fuel Oil Chemistry and One-Time Inspection | | |
| 4 | 3.3.1-33 | Stainless steel piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to pitting, crevice, and microbiologic ally influenced corrosion | Lubricati ng Oil Analysis and One-Time Inspection | | |
| 5 | 3.3.1-34 | Elastomer seals and components exposed to air - indoor uncontro lled (internal or external) | Loss of material due to Wear | A plant specific aging management program is to be evaluated. | | |
| 6 | 3.3.1-35 | PWR Only | | | | |
| 7 | 3.3.1-36 | Boraflex spent fue! storage racks neutron-absorbin g sheets exposed to treated water | Reduction of neutron-absorb ing capacity due to boraflex degradation | Boraflex Monitoring | | |
| 8 | 3.3.1-37 | Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) | Crackin g due to stress corrosion crackin g, intergranular stress corrosion crackin g | BWR Reactor Water Cleanup System | | |
| 9 | 3.3.1-38 | Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) | Crackin g due to stress corrosion crackin g | BWR Stress Corrosion Crackin g and Water Chemistry | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-39 | Stainless steel BWR spent fuel storage racks exposed to treated water > 60°C (> 140°F) | Cracking due to stress corrosion cracking | Water Chemistry | | |
| 2 | 3.3.1-40 | Steel tanks in diesel fuel oil system exposed to air - outdoor (external) | Loss of material due to general, pitting, and crevice corrosion | Aboveground Steel Tanks | | |
| 3 | 3.3.1-41 | High-strength steel closure bolting exposed to air with steam or water leakage | Cracking due to cyclic loading, stress corrosion cracking | Bolting Integrity | | |
| 4 | 3.3.1-42 | Steel closure bolting exposed to air with steam or water leakage | Loss of material due to general corrosion | Bolting Integrity | | |
| 5 | 3.3.1-43 | Steel bolting and closure bolting exposed to air - indoor uncontrolled (external) or air - outdoor (External) | Loss of material due to general, pitting, and crevice corrosion | Bolting Integrity | | |
| 6 | 3.3.1-44 | Steel compressed air system closure bolting exposed to condensation | Loss of material due to general, pitting, and crevice corrosion | Bolting Integrity | | |
| 7 | 3.3.1-45 | Steel closure bolting exposed to air - indoor uncontrolled (external) | Loss of preload due to thermal effects, gasket creep, and self-loosening | Bolting Integrity | | |
| 8 | 3.3.1-46 | Stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water > 60°C (> 140°F) | Cracking due to stress corrosion cracking | Closed-Cycle Cooling Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-47 | Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water | Loss of material due to general, pitting, and crevice corrosion | Closed- Cycle Cooling Water System | | |
| 2 | 3.3.1-48 | Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water | Loss of material due to general, pitting, crevice, and galvanic corrosion | Closed-Cycle Cooling Water System | | |
| 3 | 3.3.1-49 | Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water | Loss of material due to microbiologically influenced corrosion | Closed-Cycle Cooling Water System | | |
| 4 | 3.3.1-50 | Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water | Loss of material due to pitting and crevice corrosion | Closed- Cycle Cooling Water System | | |
| 5 | 3.3.1-51 | Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water | Loss of material due to pitting, crevice, and galvanic corrosion | Closed-Cycle Cooling Water System | | |
| 6 | 3.3.1-52 | Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water | Reduction of heat transfer due to fouling | Closed- Cycle Cooling Water System | | |
| 7 | 3.3.1-53 | Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal) | Loss of material due to general and pitting corrosion | Compressed Air Monitoring | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-54 | Stainless steel compressed air system piping, piping components , and piping elements exposed to internal condensation | Loss of material due to pitting and crevice corrosion | Compressed Air Monitoring | | |
| 2 | 3.3.1-55 | Steel ducting closure bolting exposed to air - indoor uncontrolled (external) | Loss of material due to general corrosion | External Surfaces Monitoring | | |
| 3 | 3.3.1-56 | Steel HVAC ducting and components external surfaces exposed to air - indoor uncontrolled (external) | Loss of material due to general corrosion | External Surfaces Monitoring | | |
| 4 | 3.3.1-57 | Steel piping and components external surfaces exposed to air - indoor uncontrolled (External) | Loss of material due to general corrosion | External Surfaces Monitoring | | |
| 5 | 3.3.1-58 | Steel external surfaces exposed to air - indoor uncontrolled (external), air - outdoor (external), and condensation (external) | Loss of material due to general corrosion | External Surfaces Monitoring | | |
| 6 | 3.3.1-59 | Steel heat exchanger components exposed to air - indoor uncontrolled (external) or air -outdoor (external) | Loss of material due to general, pitting, and crevice corrosion | External Surfaces Monitoring | | |
| 7 | 3.3.1-60 | Steel piping, piping components , and piping elements exposed to air - outdoor (external) | Loss of material due to general, pitting, and crevice corrosion | External Surfaces Monitoring | | |
| 8 | 3.3.1-61 | Elastomer fire barrier penetration seals exposed to air - outdoor or air - indoor uncontrolled | Increased hardness, shrinkage and loss of strength due to weathering | Fire Protection | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-62 | Aluminum piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting and crevice corrosion | Fire Protection | | |
| 2 | 3.3.1-63 | Steel fire rated doors exposed to air - outdoor or air - indoor uncontrolled | Loss of material due to Wear | Fire Protection | | |
| 3 | 3.3.1-64 | Steel piping, piping components, and piping elements exposed to fuel oil | Loss of material due to general, pitting, and crevice corrosion | Fire Protection and Fuel Oil Chemistry | | |
| 4 | 3.3.1-65 | Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - indoor uncontrolled | Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates | Fire Protection and Structures Monitoring Program | | |
| 5 | 3.3.1-66 | Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - outdoor | Concrete cracking and spalling due to freeze thaw, aggressive chemical attack, and reaction with aggregates | Fire Protection and Structures Monitoring Program | | |
| 6 | 3.3.1-67 | Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - outdoor or air - indoor uncontrolled | Loss of material due to corrosion of embedded steel | Fire Protection and Structures Monitoring Program | | |
| 7 | 3.3.1-68 | Steel piping, piping components, and piping elements exposed to raw water | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling | Fire Water System | | |
| 8 | 3.3.1-69 | Stainless steel piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting and crevice corrosion, and fouling | Fire Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-70 | Copper alloy piping, piping components, and piping elements exposed to raw water (Item 3.3.1-70) | Loss of material due to pitting, crevice, and microbiologic ally influenced corrosion, and fouling | Fire Water System | | |
| 2 | 3.3.1-71 | Steel piping, piping components , and piping elements exposed to moist air or condensation (Internal) | Loss of material due to general, pitti ng, and crevice corrosion | Inspect ion of Internal Surfa ces in Miscellaneous Piping and Ducting Component s | | |
| 3 | 3.3.1-72 | Steel HVAC ducting and components internal surfaces exposed to condensatio n (Internal) | Loss of material due to general, pitti ng, crevice, and (for drip pans and drain lines) microbiolo gically influence d corrosion | Inspec tion of Internal Surfa ces in Miscellaneous Piping and Ducting Component s | | |
| 4 | 3.3.1-73 | Steel crane structural girders in load handling system exposed to air - indoor uncontro lled (external) | Loss of material due to general corros ion | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | | |
| 5 | 3.3.1-74 | Steel cranes - rails exposed to air - indoor uncontro lled (external) | Loss of material due to Wear | Inspectio n of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | | |
| 6 | 3.3.1-75 | Elastome r seals and components exposed to raw water | Hardening and loss of strength due to elastomer degradation; loss of material due to erosion | Open-Cy cle Cooling Water System | | |
| 7 | 3.3.1-76 | Steel piping, piping components , and piping elements (without lining/ coating or with degraded lining/c oating) exposed to raw water | Loss of material due to general, pitti ng, crevice, and micro biologically infl uenced corrosion, fouling, and lining/coating de gradation | Open-Cy cle Cooling Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-77 | Steel heat exchanger components exposed to raw water | Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 2 | 3.3.1-78 | Stainless steel, nickel alloy, and copper alloy piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting and crevice corrosion | Open-Cycle Cooling Water System | | |
| 3 | 3.3.1-79 | Stainless steel piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting and crevice corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 4 | 3.3.1-80 | Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting, crevice, and microbiologically influenced corrosion | Open-Cycle Cooling Water System | | |
| 5 | 3.3.1-81 | Copper alloy piping, piping components, and piping elements, exposed to raw water | Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 6 | 3.3.1-82 | Copper alloy heat exchanger components exposed to raw water | Loss of material due to pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 7 | 3.3.1-83 | Stainless steel and copper alloy heat exchanger tubes exposed to raw water | Reduction of heat transfer due to fouling | Open-Cycle Cooling Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.3.1-84 | Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to raw water, treated water, or closed cycle cooling water | Loss of material due to selective leaching | Selective Leaching of Materials | | |
| 2 | 3.3.1-85 | Gray cast iron piping, piping components, and piping elements exposed to soil, raw water, treated water, or closed-cycle cooling water | Loss of material due to selective leaching | Selective Leaching of Materials | | |
| 3 | 3.3.1-86 | Structural steel (new fuel storage rack assembly) exposed to air - indoor uncontrolled (external) | Loss of material due to general, pitting, and crevice corrosion | Structures Monitoring Program | | |
| 4 | 3.3.1-87 | PWR Only | | | | |
| 5 | 3.3.1-88 | PWR Only | | | | |
| 6 | 3.3.1-89 | PWR Only | | | | |
| 7 | 3.3.1-90 | PWR Only | | | | |
| 8 | 3.3.1-91 | PWR Only | | | | |
| 9 | 3.3.1-92 | Galvanized steel piping, piping components, and piping elements exposed to air - indoor uncontrolled | None | None | | |
| 10 | 3.3.1-93 | Glass piping elements exposed to air, air - indoor uncontrolled (external), fuel oil, lubricating oil, raw water, treated water, and treated borated water | None | None | | |
| 11 | 3.3.1-94 | Stainless steel and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) | None | None | | |

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.3.1-95 | Steel and aluminum piping, piping components, and piping elements exposed to air - indoor controlled (external) | None | None | | |
| 3.3.1-96 | Steel and stainless steel piping, piping components, and piping elements in concrete | None | None | | |
| 3.3.1-97 | Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas | None | None | | |
| 3.3.1-98 | Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air | None | None | | |
| 3.3.1-99 | PWR Only | | | | |



### 3.3.2.1 AMR Results That Are Consistent with The GALL Report

<u>Summary of Information in the Application</u>

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 PNPS LRA is acceptable.

In PNPS LRA Section 3.3.2.1, the applicant identified the materials, environments, aging effects requiring management, and aging management programs for the following auxiliary systems:

- Standby Liquid Control (SLC) System
- SSW System
- Reactor Building Closed Cooling Water (RBCCW) System
- Emergency Diesel Generator (EDG) System
- Station Blackout Diesel (SBO) System
- Security Diesel
- Fuel Oil (FO) System
- Instrument Air (IA)
- Fire Protection — Water System

- Fire Protection — Halon System
- Heating, Ventilation and Air Conditioning (HVAC) Systems
- Primary Containment Atmosphere Control (PCAC) System
- Fuel Pool Cooling (FPC) and Fuel Handling and Storage Systems
- Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)

The aging management programs identified by the applicant for the above auxiliary systems are:

- Boraflex Monitoring (B.1.1)
- Buried Piping and Tank Inspection(B.1.2)
- Diesel Fuel Monitoring (B.1.10)
- Fire Protection (B.1.13.1)
- Fire Water System (B.1.13.2)
- Flow-Accelerated Corrosion (B.1.14)
- Heat Exchanger Monitoring (B.1.15)
- Instrument Air Quality (B.1.17)
- Oil Analysis (B.1.22)
- One-Time Inspection (B.1.23)
- Periodic Surveillance and Preventive Maintenance (B.1.24)
- Selective Leaching (B.1.27)
- Service Water Integrity (B.1.28)
- System Walkdowns (B.1.30)
- Water Chemistry Control - Auxiliary Systems (B.1.32.1)
- Water Chemistry Control - BWR (B.1.32.2)
- Water Chemistry Control - Closed Cooling Water (B.1.32.3)



Project Team Evaluation

The project team reviewed its assigned PNPS LRA AMR 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 components that are subject to an AMR.

[This section addresses consistency with the GALL Report. For each Tables 1 entry for which no further evaluation is required by the SRP-LR and the project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicant's basis for why it is acceptable. Identify documents reviewed, full title, revision, and/or date of issue, and the reviewer's basis for accepting the differences. If additional information is requested from the applicant to develop an acceptable reviewer finding, cite the applicant's docketed letter, commitment or other docketed LRA supplement. The docketed item is to be cited by title, date and ADAMs accession number. Use Template 5 below for this purpose. There is to be a separate, numbered section for each aging effect in Table 1 that is to be discussed. Otherwise there is no need to discuss that particular Table 1 entry]

[This section also addresses Table 2 regarding consistency with the GALL Report when project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicants basis for why it is acceptable (for example, a different Note is used). This section also addresses Note E and why using an AMP that is different than that recommended in GALL Report is acceptable (see Example 13 at the end of this document)]

**Template 5 - <u>Aging Management Reviews Results That Are Consistent With the GALL Report - With Identified Difference/Issue</u>**

3.[Y].2.1.S] <u>Title of Aging Effect/Mechanism</u>

In the discussion section of Table 3.Y.1, Item [NUMBER] of the PNPS LRA, the applicant stated that [provide description of in the LRA]. During the audit and review, the project team noted that [provide description of differences, the applicant's basis.]

[Identify documents reviewed and basis for acceptability, project team evaluation]

On the basis of its review, the project team found that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.



<u>Conclusion</u>

The project team has evaluated the applicant's claim of consistency with the GALL Report. The project team also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the project team found that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team found that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.3.2.2 AMR Results For Which Further Evaluation Is Recommended By The GALL Report

<u>Summary of Information in the Application</u>

In PNPS LRA Section 3.3.2.2, the applicant provides further evaluation of aging management as recommended by the GALL Report for the auxiliary systems subject to an aging management review. The applicant also provides information concerning how it will manage the related aging effects.

Project Team Evaluation

For some AMR line-items assigned to the project team in the PNPS LRA Tables 3.3.1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNPS LRA Section 3.3.2.2 against the criteria provided in the SRP-LR Section 3.3.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 AMR line-item in Section 3.3 citing the item in Table 1.

3.3.2.2.1 Cumulative Fatigue Damage

The project team reviewed PNPS LRA Section 3.3.2.2.1 against the criteria in SRP-LR Section 3.3.2.2.1.

The SRP-LR Section 3.3.2.2.1 states 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). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis" or Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses" of this SRP-LR.

In the PNPS LRA Section 3.3.2.2.1, the applicant states that, where cracking-fatigue is identified as an aging effect requiring management, the analysis of 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). The evaluation of this TLAA is addressed in Section 4.3 of the PNPS LRA.

[Identify documents reviewed and basis for acceptability. project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.3.1 for further evaluation. The project team found 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).

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

The project team reviewed PNPS LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2.

SRP-LR Section 3.3.2.2.2 states that the reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water. The existing program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may have been inadequate. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.3.2.2.2, the applicant states that reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water. However, heat transfer is not a license renewal intended function for any of the auxiliary system heat exchangers with stainless steel tubes exposed to treated water. Therefore, this item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found 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. The project team found 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).

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking

3.3.2.2.3.1 Cracking Due to Stress Corrosion Cracking [Item 1]

The project team reviewed PNPS LRA Section 3.3.2.2.3.1 against the criteria in SRP-LR Section 3.3.2.2.3.1.

SRP-LR Section 3.3.2.2.3.1 states that cracking due to SCC could occur in the stainless steel piping, piping components, and piping elements of the BWR Standby Liquid Control system that are exposed to sodium pentaborate solution greater than 60°C (>140°F). The existing aging management program relies on monitoring and control of water chemistry to manage the aging effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.3.2.2.3.1, the applicant states that cracking due to SCC can occur in the stainless steel piping, piping components, and piping elements of the BWR standby liquid control (SLC) system that are exposed to sodium pentaborate solution greater than 140°F. At PNPS the sodium pentaborate solution in the SLC system does not exceed 140°F. Therefore cracking due to SCC is not an aging effect requiring management for the SLC system. This item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.3.1 for further evaluation. The project team found 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).

3.3.2.2.3.2 Cracking Due to Stress Corrosion Cracking [Item 2]

The project team reviewed PNPS LRA Section 3.3.2.2.3.2 against the criteria in SRP-LR Section 3.3.2.2.3.2.

SRP-LR Section 3.3.2.2.3.2 states that cracking due to SCC could occur in stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 60°C (>140°F). The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.3.2, the applicant states that cracking due to SCC in stainless steel heat exchanger components exposed to treated water greater than 140°F is an aging effect requiring management at PNPS. There are no auxiliary system components at PNPS with stainless steel cladding. For PNPS auxiliary systems these stainless steel heat exchanger components are managed by the Water Chemistry Control – BWR Program. This program monitors parameters and contaminants to ensure they remain within the limits specified by the EPRI guidelines. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program for managing cracking using visual and ultrasonic inspection techniques.



[Identify documents reviewed and basis for acceptability. Project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.3.2 for further evaluation. The project team found 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).

3.3.2.2.3.3 Cracking Due to Stress Corrosion Cracking [Item 3]

The project team reviewed PNPS LRA Section 3.3.2.2.3.3 against the criteria in SRP-LR Section 3.3.2.2.3.3.

SRP-LR Section 3.3.2.2.3.3 states that cracking due to SCC could occur in stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.3.3, the applicant states that cracking due to SCC in stainless steel diesel engine exhaust piping exposed to diesel exhaust is an aging effect requiring management at PNPS. At PNPS cracking of stainless steel exhaust piping in the station blackout diesel generator system is managed by the Periodic Surveillance and Preventive Maintenance Program. This program uses visual and other NDE techniques to manage cracking of the piping. These inspections will manage the aging effect of cracking such that the intended function of the component will not be affected.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.3.3 for further evaluation. The project team found 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).

3.3.2.2.4 <u>Cracking Due to Stress Corrosion Cracking and Cyclic Loading</u>

3.3.2.2.4.1 <u>Cracking Due to Stress Corrosion Cracking and Cyclic Loading [Item 1]</u>

The project team reviewed PNPS LRA Section 3.3.2.2.4.1 against the criteria in SRP-LR Section 3.3.2.2.4.1.

SRP-LR Section 3.3.2.2.4.1 states that cracking due to SCC and cyclic loading could occur in stainless steel PWR nonregenerative heat exchanger components exposed to treated borated water greater than 60°C (>140°F) in the chemical and volume control system. The existing aging management program on monitoring and control of primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL Report recommends that a plant-specific aging management program be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.

In the PNPS LRA Section 3.3.2.2.4.1, the applicant states that cracking due to SCC and cyclic loading could occur in stainless steel PWR nonregenerative heat exchanger components exposed to treated borated water greater than 140°F in the chemical and volume control system. PNPS is a BWR and does not have a stainless steel nonregenerative heat exchanger exposed to treated borated water. This item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.4.1 for further evaluation. The project team found 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).

3.3.2.2.4.2 <u>Cracking Due to Stress Corrosion Cracking and Cyclic Loading [Item 2]</u>

The project team reviewed PNPS LRA Section 3.3.2.2.4.2 against the criteria in SRP-LR Section 3.3.2.2.4.2.

SRP-LR Section 3.3.2.2.4.2 states that cracking due to SCC and cyclic loading could occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 60°C (>140°F). The existing aging management program relies on monitoring and control of primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL Report recommends that a plant-specific aging management program be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.4.2, the applicant states that cracking due to SCC and cyclic loading could occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 140°F. PNPS is a BWR and does not have a stainless steel nonregenerative heat exchanger exposed to treated borated water. This item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.4.2 for further evaluation. The project team found 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).

3.3.2.2.4.3 <u>Cracking Due to Stress Corrosion Cracking and Cyclic Loading [Item 3]</u>

The project team reviewed PNPS LRA Section 3.3.2.2.4.3 against the criteria in SRP-LR Section 3.3.2.2.4.3.

SRP-LR Section 3.3.2.2.4.3 states that cracking due to SCC and cyclic loading could occur for the stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system. The existing aging management program relies on monitoring and control of primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL Report recommends that a plant-specific aging management program be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.4.3, the applicant states that cracking due to SCC and cyclic loading could occur for the stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system. PNPS is a BWR and does not have a chemical volume control system. This item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.4.3 for further evaluation. The project team found 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).

3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

3.3.2.2.5.1 Hardening and Loss of Strength Due to Elastomer Degradation [Item 1]

The project team reviewed PNPS LRA Section 3.3.2.2.5.1 against the criteria in SRP-LR Section 3.3.2.2.5.1.

SRP-LR Section 3.3.2.2.5.1 states that hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components of heating and ventilation systems exposed to air – indoor uncontrolled (internal/external. The GALL Report recommends further evaluation of a plant-specific aging management programto ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.5.1, the applicant states that cracking and change in material properties due to elastomer degradation in elastomer duct flexible connections of the heating, ventilation and air conditioning systems exposed to air-indoor are aging effects requiring management at PNPS. These aging effects are managed by the Periodic Surveillance and Preventive Maintenance (PSPM) Program. The PSPM Program includes visual inspections and physical manipulation of the flexible connections to confirm that the components are not experiencing any aging that would affect accomplishing their intended functions.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.5.1 for further evaluation. The project team found 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).

3.3.2.2.5.2 Hardening and Loss of Strength Due to Elastomer Degradation [Item 2]

The project team reviewed PNPS LRA Section 3.3.2.2.5.2 against the criteria in SRP-LR Section 3.3.2.2.5.2.

SRP-LR Section 3.3.2.2.5.2 states that hardening loss of strength due to elastomer degradation could occur in elastomer linings of the filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR) exposed to treated water or to treated borated water. The GALL Report recommends that a plant-specific aging management program be evaluated to determine and assesses the qualified life of the linings in the environment to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.5.2, the applicant states that for the auxiliary systems at PNPS, no credit is taken for any elastomer linings to prevent loss of material from the underlying carbon steel material such that the material is identified as carbon steel for the aging management review. This item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.5.2 for further evaluation. The project team found 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).

3.3.2.2.6 <u>Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion</u>



The project team reviewed PNPS LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6.

SRP-LR Section 3.3.2.2.6 states that a reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or to treated borated water. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.6, the applicant states that the loss of material and cracking are aging effects requiring management for Boral spent fuel storage racks exposed to a treated water environment. These aging effects are managed by the Water Chemistry Control – BWR Program.

Reduction of neutron-absorbing capacity is insignificant and requires no aging management. The potential for aging effects due to sustained irradiation of Boral was previously evaluated by the staff (BNL-NUREG-25582 dated January 1979; NUREG-1787, VC Summer SER, paragraph 3.5.2.4.2, page 3-408) and determined to be insignificant. Plant operating experience with the Boral coupon inspected in 2000 is consistent with the staff's conclusion and an aging management program is not required.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.6 for further evaluation. The project team found 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).

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

3.3.2.2.7.1 Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.3.2.2.7.1 against the criteria in SRP-LR Section 3.3.2.2.7.1.

SRP-LR Section 3.3.2.2.7.1 states that a loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements, including the tubing, valves, and tanks in the reactor coolant pump oil collection system, exposed to lubricating oil (as part of the fire protection system). The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In addition, corrosion may occur at locations in the reactor coolant pump oil collection tank where water from wash downs may accumulate. Therefore, the effectiveness of the program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion, to include determining the thickness of the lower portion of the tank. A one-time inspection 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 the PNPS LRA Section 3.3.2.2.7.1, the applicant states that steel piping and components in auxiliary systems at PNPS that are exposed to lubricating oil are managed by the Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

PNPS is a BWR with an inert containment atmosphere and as a result has no reactor coolant pump oil collection system.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7.1 for further evaluation. The project team found 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).

3.3.2.2.7.2 <u>Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 2]</u>

The project team reviewed PNPS LRA Section 3.3.2.2.7.2 against the criteria in SRP-LR Section 3.3.2.2.7.2.

SRP-LR Section 3.3.2.2.7.2 states that the loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements in the BWR reactor water cleanup and shutdown cooling systems exposed to treated water. The existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from general, pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. 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 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 the PNPS LRA Section 3.3.2.2.7.2, the applicant states that PNPS does not have a separate shutdown cooling system. Loss of material due to general, pitting, and crevice corrosion in carbon steel piping and components in other auxiliary systems exposed to treated water are managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7.2 for further evaluation. The project team found 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).

3.3.2.2.7.3 <u>Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 3]</u>

The project team reviewed PNPS LRA Section 3.3.2.2.7.3 against the criteria in SRP-LR Section 3.3.2.2.7.3.

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SRP-LR Section 3.3.2.2.7.3 states that a loss of material due to general (steel only) pitting and crevice corrosion could occur for steel and stainless steel diesel exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.7.3, the applicant states that the loss of material due to general (steel only) pitting and crevice corrosion for carbon steel and stainless steel diesel exhaust piping and components exposed to diesel exhaust in the emergency diesel generator, station blackout diesel generator, and security diesel generator systems is managed by the Periodic Surveillance and Preventive Maintenance Program. This program uses visual and other NDE techniques to manage loss of material for these components. The carbon steel diesel exhaust piping and components in the fire protection system is managed by the Fire Protection Program. The Fire Protection Program uses visual inspections of diesel exhaust piping and components to manage loss of material. These inspections in the PSPM and fire protection programs will manage the aging effect of loss of material such that the intended function of the components will not be affected.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7.3 for further evaluation. The project team found 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).

3.3.2.2.8 <u>Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)</u>

The project team reviewed PNPS LRA Section 3.3.2.2.8 against the criteria in SRP-LR Section 3.3.2.2.8.

SRP-LR Section 3.3.2.2.8 states that a Loss of material due to general, pitting, crevice corrosion, and microbiologically-influenced corrosion (MIC) could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

In the PNPS LRA Section 3.3.2.2.8, the applicant states that the loss of material due to general, pitting, crevice, and MIC for carbon steel (with or without coating or wrapping) piping and components buried in soil in the salt service water, fuel oil, and fire protection-water systems at PNPS is managed by the Buried Piping and Tanks Inspection Program. This program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel components. Buried components will be inspected when excavated during maintenance. An inspection will be performed within 10 years of entering the period of extended operation, unless an opportunistic inspection occurred within this ten-year period. This program will manage the aging effect of loss of material such that the intended function of the components will not be affected.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.8 for further evaluation. The project team found 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).

3.3.2.2.9 Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling

3.3.2.2.9.1 Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling [Item1]

The project team reviewed PNPS LRA Section 3.3.2.2.9.1 against the criteria in SRP-LR Section 3.3.2.2.9.1.



SRP-LR Section 3.3.2.2.9.1 states that a loss of material due to general, pitting, crevice, MIC, and fouling could occur for steel piping, piping components, piping elements, and tanks exposed to fuel oil. The existing aging management program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion or fouling. Corrosion or fouling may occur at locations where contaminants accumulate. The effectiveness of the fuel oil chemistry control 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, crevice, MIC, and fouling to verify the effectiveness of the fuel oil chemistry 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 the PNPS LRA Section 3.3.2.2.9.1, the applicant states that fouling is not an aging effect requiring management for the fuel oil system at PNPS. Loss of material due to general, pitting, crevice, and MIC for carbon steel piping and components exposed to fuel oil is an aging effect requiring management at PNPS and these components are managed by the Diesel Fuel Monitoring Program. This program includes sampling and monitoring of fuel oil quality to ensure they remain within the limits specified by the ASTM standards. Maintaining parameters within limits ensures that significant loss of material will not occur. Ultrasonic inspections of storage tank bottoms where water and contaminants accumulate will be performed to confirm the effectiveness of the Diesel Fuel Monitoring Program. In addition, operating experience at PNPS has confirmed the effectiveness of this program in maintaining fuel oil quality within limits such that loss of material will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.9.1 for further evaluation. The project team found 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).

3.3.2.2.9.2 Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling [Item 2]

The project team reviewed PNPS LRA Section 3.3.2.2.9.2 against the criteria in SRP-LR Section 3.3.2.2.9.2.

SRP-LR Section 3.3.2.2.9.2 states that a loss of material due to general, pitting, crevice, MIC, and fouling could occur for steel heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil 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 the PNPS LRA Section 3.3.2.2.9.2, the applicant states that the loss of material due to general, pitting, crevice, MIC and fouling for carbon steel heat exchanger components exposed to lubricating oil is an aging effect requiring management in the auxiliary systems at PNPS, and is managed by the Oil Analysis Program. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion or fouling. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion and fouling has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.9.2 for further evaluation. The project team found 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).

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion

3.3.2.2.10.1 Loss of Material Due to Pitting and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.3.2.2.10.1 against the criteria in SRP-LR Section 3.3.2.2.10.1.

SRP-LR Section 3.3.2.2.10.1 states that a loss of material due to pitting and crevice corrosion could occur in BWR and PWR steel piping with elastomer lining or stainless steel cladding that are exposed to treated water and treated borated water if the cladding or lining is degraded. The existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting, or crevice corrosion. 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 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 the PNPS LRA Section 3.3.2.2.10.1, the applicant states that the loss of material due to pitting and crevice corrosion could occur in BWR and PWR steel piping with elastomer lining or stainless steel cladding that are exposed to treated water and treated borated water if the cladding or lining is degraded. For the auxiliary systems at PNPS no credit is taken for any elastomer linings or stainless steel cladding to prevent loss of material from the underlying carbon steel material such that the material is identified as carbon steel for the aging management review. This item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.1 for further evaluation. The project team found 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).

3.3.2.2.10.2 Loss of Material Due to Pitting and Crevice Corrosion [Item 2]

The project team reviewed PNPS LRA Section 3.3.2.2.10.2 against the criteria in SRP-LR Section 3.3.2.2.10.2.

SRP-LR Section 3.3.2.2.10.2 states that a loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum piping, piping components, piping elements, and for stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting, or crevice corrosion. 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 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 the PNPS LRA Section 3.3.2.2.10.2, the applicant states that there are no aluminum components exposed to treated water in the auxiliary systems at PNPS. The loss of material due to pitting and crevice corrosion for stainless steel piping and components, and for stainless steel heat exchanger components exposed to treated water in the auxiliary systems at PNPS is managed by the Water Chemistry Control – BWR Program. The effectiveness of the program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.2 for further evaluation. The project team found 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).



3.3.2.2.10.3 Loss of Material Due to Pitting and Crevice Corrosion [Item 3]

The project team reviewed PNPS LRA Section 3.3.2.2.10.3 against the criteria in SRP-LR Section 3.3.2.2.10.3.

SRP-LR Section 3.3.2.2.10.3 states that a loss of material due to pitting and crevice corrosion could occur for copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external). The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.10.3, the applicant states that the loss of material due to pitting and crevice corrosion for copper alloy components exposed to condensation (external) in the HVAC and other auxiliary systems is managed by the System Walkdown and Periodic Surveillance and Preventive Maintenance (PSPM) Programs. These programs include a periodic visual inspection and the PSPM Program includes other NDE techniques to manage loss of material of the components. These inspections will manage the aging effect of loss of material such that the intended function of the components will not be affected.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.3 for further evaluation. The project team found 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).

3.3.2.2.10.4 Loss of Material Due to Pitting and Crevice Corrosion [Item 4]

The project team reviewed PNPS LRA Section 3.3.2.2.10.4 against the criteria in SRP-LR Section 3.3.2.2.10.4.

SRP-LR Section 3.3.2.2.10.4 states that a loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.3.2.2.10.4, the applicant states that a loss of material due to pitting and crevice corrosion for copper alloy components exposed to lubricating oil in auxiliary systems at PNPS is managed by the Oil Analysis Program which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.4 for further evaluation. The project team found 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).

3.3.2.2.10.5 Loss of Material Due to Pitting and Crevice Corrosion [Item 5]

The project team reviewed PNPS LRA Section 3.3.2.2.10.5 against the criteria in SRP-LR Section 3.3.2.2.10.5.

SRP-LR Section 3.3.2.2.10.5 states that a loss of material due to pitting and crevice corrosion could occur for HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. The GALL Report recommends further evaluation of a plantspecific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.10.5, the applicant states that the loss of material due to pitting and crevice corrosion could occur for HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. At PNPS there are no aluminum components or stainless steel ducting exposed to condensation in the HVAC systems. However, this item can be applied to stainless steel components exposed to condensation, both internal and external, in other systems. The System Walkdown Program will manage loss of material in stainless steel components exposed externally to condensation. The Periodic Surveillance and Preventive Maintenance Program will manage loss of material in stainless steel components exposed internally to condensation. These programs include a periodic visual inspection and the PSPM Program includes other NDE techniques to manage loss of material of the components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.5 for further evaluation. The project team found 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).

3.3.2.2.10.6 Loss of Material Due to Pitting and Crevice Corrosion [Item 6]



The project team reviewed PNPS LRA Section 3.3.2.2.10.6 against the criteria in SRP-LR Section 3.3.2.2.10.6.

SRP-LR Section 3.3.2.2.10.6 states that a loss of material due to pitting and crevice corrosion could occur for copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.10.6, the applicant states that the loss of material due to pitting and crevice corrosion could occur for copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. At PNPS there are no copper alloy components exposed to condensation in the Fire Protection systems. However, this item can be applied to copper alloy components exposed to internal condensation in other systems. The Periodic Surveillance and Preventive Maintenance and One-Time Inspection Programs will manage loss of material in copper alloy components exposed internally to untreated air, which is equivalent to condensation, through the use of visual inspections or other NDE techniques.

The PNPS Instrument Air Quality Program will manage loss of material in copper alloy components exposed internally to treated air. The instrument air quality maintains humidity and particulate within acceptable limits, thereby preserving the environment of treated air that is not conducive to corrosion. This is equivalent to the management of loss of material in steel and stainless steel components addressed in Item Numbers 3.3.1-53 and 54 respectively.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.6 for further evaluation. The project team found 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).

3.3.2.2.10.7 Loss of Material Due to Pitting and Crevice Corrosion [Item 7]

The project team reviewed PNPS LRA Section 3.3.2.2.10.7 against the criteria in SRP-LR Section 3.3.2.2.10.7.

SRP-LR Section 3.3.2.2.10.7 states that a loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.3.2.2.10.7, the applicant states that the loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. At PNPS there are no stainless steel components exposed to soil in the Auxiliary systems. This item is not applicable to PNPS Auxiliary systems.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.7 for further evaluation. The project team found 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).

3.3.2.2.10.8 Loss of Material Due to Pitting and Crevice Corrosion [Item 8]

The project team reviewed PNPS LRA Section 3.3.2.2.10.8 against the criteria in SRP-LR Section 3.3.2.2.10.8.

SRP-LR Section 3.3.2.2.10.8 states that a loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements of the BWR Standby Liquid Control System that are exposed to sodium pentaborate solution. The existing aging management program relies on monitoring and control of water chemistry to manage the aging effects of loss of material due to pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause loss of material due to pitting and crevice corrosion. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure this aging is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.3.2.2.10.8, the applicant states that the loss of material due to pitting and crevice corrosion for stainless steel piping and components of the standby liquid control system exposed to sodium pentaborate solution is managed at PNPS by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.8 for further evaluation. The project team found 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).

3.3.2.2.11 <u>Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion</u>



The project team reviewed PNPS LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11.

SRP-LR Section 3.3.2.2.11 states that a loss of material due to pitting, crevice, and galvanic corrosion could occur for copper alloy piping, piping components, and piping elements exposed to treated water. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure this aging is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.3.2.2.11, the applicant states that the loss of material due to pitting, crevice, and galvanic corrosion could occur for copper alloy piping and components exposed to treated water. At PNPS there are no copper alloy components exposed to treated water in the auxiliary systems. However, this item can be applied to copper alloy components exposed to treated water in the high pressure coolant injection and reactor core isolation cooling systems. The Water Chemistry Control – BWR Program will manage loss of material for these components. The effectiveness of the program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found 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 found 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).

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

3.3.2.2.12.1 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.3.2.2.12.1 against the criteria in SRP-LR Section 3.3.2.2.12.1.

SRP-LR Section 3.3.2.2.12.1 states that a loss of material due to pitting, crevice, and MIC could occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. The existing aging management program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion. However, corrosion may occur at locations where contaminants accumulate and the effectiveness of fuel oil chemistry control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the fuel oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.



In the PNPS LRA Section 3.3.2.2.12.1, the applicant states that there are no aluminum components exposed to fuel oil in the auxiliary systems at PNPS. The loss of material due to pitting, crevice, and MIC in stainless steel and copper alloy piping, and components exposed to fuel oil is an aging effect requiring management at PNPS and these components are managed by the Diesel Fuel Monitoring Program. This program includes sampling and monitoring of fuel oil quality to ensure they remain within the limits specified by the ASTM standards. Maintaining parameters within limits ensures that significant loss of material will not occur. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining fuel oil quality within limits such that loss of material will not affect the intended functions of these stainless steel and copper alloy components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.12.1 for further evaluation. The project team found 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).

3.3.2.2.12.2 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion [Item 2]

The project team reviewed PNPS LRA Section 3.3.2.2.12.2 against the criteria in SRP-LR Section 3.3.2.2.12.2.

SRP-LR Section 3.3.2.2.12.2 states that a loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.3.2.2.12.2, the applicant states that a loss of material due to pitting, crevice, and MIC in stainless steel piping and components exposed to lubricating oil is managed by the Oil Analysis Program which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.12.2 for further evaluation. The project team found 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).

3.3.2.2.13 <u>Loss of Material Due to Wear</u>

The project team reviewed PNPS LRA Section 3.3.2.2.13 against the criteria in SRP-LR Section 3.3.2.2.13.

SRP-LR Section 3.3.2.2.13 states that a loss of material due to wear could occur in the elastomer seals and components exposed to air indoor uncontrolled (internal or external). The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

In the PNPS LRA Section 3.3.2.2.13, the applicant states that a loss of material due to wear could occur in the elastomer seals and components exposed to air indoor uncontrolled (internal or external). Wear is the removal of surface layers due to relative motion between two surfaces. At PNPS, in the auxiliary systems, this specific aging effect for elastomers is not applicable based on operating experience. Where the aging effects of change in material properties and cracking are identified for elastomer components, they are managed by the Periodic Surveillance and Preventive Maintenance Program. This item is not applicable to PNPS auxiliary systems.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.13 for further evaluation. The project team found 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).

3.3.2.2.14 <u>Loss of Material Due to Cladding Breach</u>

The project team reviewed PNPS LRA Section 3.3.2.2.14 against the criteria in SRP-LR Section 3.3.2.2.14.

SRP-LR Section 3.3.2.2.14 states that a loss of material due to cladding breach could occur for PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks, and recommends further evaluation of a plant-specific aging management program to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

In the PNPS LRA Section 3.3.2.2.14, the applicant states that cracking due to underclad cracking could occur for PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. PNPS is a BWR and has no charging pumps. This item is not applicable to PNPS.



[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.14 for further evaluation. The project team found 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).

3.3.2.2.15 <u>Quality Assurance for Aging Management of Non-safety-Related Components</u>

PNPS LRA Section 3.3.2.2.15 is reviewed by NRR DE staff and will be addressed separately in Section 3 of the SER related to the PNPS LRA.

In PNPS LRA, Section 3.3.2.15, the applicant states that Appendix B Section B.0.3 of the LRA contains a discussion of PNPS quality assurance procedures and administrative controls for aging management programs.

<u>Conclusion</u>

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 determined that the applicant adequately addressed the issues that were further evaluated. The project team found 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).

### 3.3.2.3 AMR Results That Are Not Consistent With The GALL Report Or Not Addressed In The GALL Report

Summary of Information in the Application

In PNPS LRA Table 3.3.1, Summary of Aging Management Evaluations for the Auxiliary Systems, the applicant provided information regarding components or material/environment combination in the GALL Report that it evaluated and identified as not applicable to its plant.

In PNPS LRA Tables 3.3.2.1.1 through 3.3.2.1.41, the applicant provided additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report. Specifically, the applicant indicated, via Notes F through J, that neither the identified component nor the material/ environment combination is evaluated in the GALL Report and provided information concerning how the aging effect requiring management will be managed.

Project Team Evaluation



The project team reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

Aging Effect/Mechanism in Table 3.3.1 That Are Not Applicable for PNPS

[This section is for write-up of the AMR line-items that the applicant claims are not used or not applicable to its plant in LRA Table 1. The write-up does not include the "further evaluation required" in Table 1 since they are evaluated in Section 3.[Y].2. In addition, the evaluation is not necessary if the plant is of a different vintage (PWR vs. BWR)]

The project team reviewed PNPS LRA Table 3.3.1, which provides a summary of aging management evaluations for the auxiliary systems evaluated in the GALL Report.

In PNPS LRA Table 3.3.1, item 3.3.1-3 discussion column, the applicant states that the reduction of heat transfer due to fouling for stainless steel heat exchanger tubes exposed to treated water is not applicable to PNPS because heat transfer is not a license renewal intended function for any of the auxiliary system heat exchangers with stainless steel tubes exposed to treated water.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.3.1, item 3.3.1-4 discussion column, the applicant states that cracking due to stress corrosion cracking of stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution >60°C (>140°F) is not applicable to PNPS because the operating temperature of the standby liquid control system is below the 140°F threshold for cracking in stainless steel.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.3.1, item 3.3.1-10 discussion column, the applicant states that cracking due to stress corrosion cracking, cyclic loading of high-strength steel closure bolting exposed to air with steam or water leakage is not applicable to PNPS because a high-strength bolting system is not used in the auxiliary system at PNPS.

[The project team evaluation, if applicable]



On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.1.1, item 3.3.1-12 discussion column, the applicant states that hardening and loss of strength due to elastomer degradation of elastomer lining exposed to treated water or treated borated water is not applicable to PNPS because there are no elastomer lined components exposed to treated water in the auxiliary systems at PNPS.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.3.1, item 3.3.1-15 discussion column the applicant states that the loss of material due to general, pitting, and crevice corrosion of steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil is not applicable to PNPS because PNPS operates with an inert containment environment and reactor coolant pump oil collection components are not required.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, item 3.3.1-16 discussion column the applicant states that the loss of material due to general, pitting, and crevice corrosion in steel reactor coolant pump oil collection system tank exposed to lubricating oil is not applicable to PNPS because reactor coolant pump oil collection components are not required.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.3.1, item 3.3.1-22 discussion column the applicant states that the loss of material due to pitting and crevice corrosion for steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water and treated borated water is not applicable to PNPS because lined or clad steel components have no intended function in the fuel pool cooling system.

[The project team evaluation, if applicable]



On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, item 3.3.1-29 discussion column the applicant states that the loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, and piping elements exposed to soil is not applicable to PNPS because there are no stainless steel components exposed to soil in the auxiliary system.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, item 3.3.1-34 discussion column the applicant states that the loss of material due to wear of elastomer seal and components exposed to uncontrolled internal or external air is not applicable to PNPS because there are no elastomer components with wear as an applicable aging effect.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, item 3.3.1-39 discussion column the applicant states that cracking due to stress corrosion cracking of stainless steel BWR spent fuel storage racks exposed to treated water >60°C (>140°F) is not applicable to PNPS because there are no stainless steel spent fuel storage components with intended functions exposed to treated water >60°F (>140°F).

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, Item 3.3.1-41 discussion column the applicant states that the cracking due to cyclic loading, stress corrosion cracking of high-strength steel closure bolting exposed to air with steam or water leakage is not applicable to PNPS because high-strength steel bolting is not used in the auxiliary systems at PNPS.

[The project team evaluation, if applicable]



On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.3.1, Item 3.3.1-45 discussion column the applicant states that loss of preload due to thermal effects, gasket creep, and self-loosening of steel closure bolting exposed to uncontrolled indoor or outdoor air is not applicable to PNPS because the loss of preload is a design driven effect and not an aging effect requiring aging management. Bolting at PNPS is standard grade B7 carbon steel, or similar material, except in rare specialized applications such as applications where stainless steel bolting is utilized. Loss of preload due to stress relaxation (creep) would only be a concern in very high temperature applications (>700°F) as stated in the ASME Code, Section II, Part D, Table 4. No PNPS bolting operates at > 700°F. Therefore, loss of preload due to stress relaxation (creep) is not an applicable aging effect for auxiliary systems. Other issues that may result in pressure boundary joint leakage are improper design or maintenance issues. Improper bolting application (design) and maintenance issues are current plant operational concerns and not related to aging effects or mechanisms that require management during the period of extended operation.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, Item 3.3.1-62 discussion column the applicant states that the loss of material due to pitting and crevice corrosion of aluminum piping, piping components, and piping elements exposed to raw water is not applicable to PNPS because there are no aluminum components with intended functions exposed to raw water in the auxiliary systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, Item 3.3.1-77 discussion column the applicant states that the loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling of steel heat exchanger components exposed to raw water is not applicable to PNPS because steel heat exchangers components are not exposed to raw water in the auxiliary systems at PNPS.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.



In PNPS Table 3.3.1, Item 3.3.1-80 discussion column the applicant states that the loss of material due to pitting, crevice, and microbiologically influenced corrosion of stainless steel and copper alloy piping components, and piping elements exposed to raw water is not applicable to PNPS because the aging affect applies to EDG system components. At PNPS these components are not exposed to raw water.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, Item 3.3.1-92 discussion column the applicant states that the aging of galvanized steel piping, piping components, and piping elements exposed to uncontrolled indoor air is not applicable because, at PNPS, galvanized steel surfaces are evaluated as steel surfaces for the aging management program for the auxiliary systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.3.1, Item 3.3.1-98 discussion column the applicant states that the aging of steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air is not applicable to NPNS because dried (treated) air is maintained as an environment as a result of the Instrument Air Quality Program, so aging effects may occur without the program.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the auxiliary systems at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

[Repeat the above three paragraphs, if applicable, for all items that the applicant claims is not applicable to its plant]

[If there are RAIs or issues that affect all Tables, provide discussion and evaluation here]

[If the LRA lists a series of components which have no aging effect and therefore do not require aging management, the following writeup may be used, as appropriate]

<u>Auxiliary Systems AMR Line Items That Has No Aging Effect (PNPS LRA Tables 3.3.2-1 through 3.3.2-14-4, 3.3.2-14-6 through 3.3.2-14-8, 3.3.2-14-12 through 3.3.2-16, 3.3.2-14-19 through 3.3.2-14-34)</u>



In PNPS LRA Tables 3.3.2-1 through 3.3.2-14-4, 3.3.2-14-6 through 3.3.2-14-8, 3.3.2-14-12 through 3.3.2-16, 3.3.2-14-19 through 3.3.2-14-34, the applicant identified line-items where no aging effects were identified as a result of its aging review process.. Specific instances in which the applicant states that no aging effects were identified occurred in the following areas:

- for piping or thermowellcomponents fabricated from titanium exposed to external condensation. This material is not in NUREG-1801 for components.

- for bolting or components fabricated from stainless steel exposed to an outdoor air environment This environment is not in NUREG-1801 for this component and material.

- for nozzle, valve body, piping, tubing, damper housing, duct work and condensing pot components fabricated from stainless steel exposed to an indoor air environment. This environment is not in NUREG-1801 for this component and material.

- for flow arrestor components fabricated from aluminum exposed to an outdoor air environment This environment is not in NUREG-1801 for this component and material.

- for tank components fabricated from fiberglass exposed to a fuel oil or soil environment. This material is not in NUREG-1801 for this component.

- for flex hose components fabricated from fluoropolymer (Teflon) exposed to a treated air environment This material is not in NUREG-1801 for this component.

- for flex hose components fabricated from stainless steel braid with Teflon liner exposed to indoor air or halon environment. This material is not in NUREG-1801 for this component.

- for tubing and valve body components fabricated from copper alloy (>15% zinc) exposed to an indoor air environment. This environment is not in NUREG-1801 for this component and material.

- for plastic components in various environments

**(Need to ask PNPS what plastic material they are using)**

PVC is unaffected by water, concentrated alkalies, and non-oxidizing acids, oils and ozone. PVC is also unaffected by sunlight and humidity changes.

Unlike metals, thermoplastics do not display corrosion rates. Rather than depending on an oxide layer for protection, they depend on chemical resistance to the environment to which they are exposed. The use of thermoplastics in a water environment is a design driven criteria. Therefore based on industry experience review and the assumption of proper design and application of the material, aging of thermoplastics in treated water, raw water, and fuel oil environment is not an applicable aging effect.



On the basis of its review of current industry research and operating experience, the project team found that condensation external and raw water internal environments, on plastic and glass will not result in aging that will be of concern during the period of extended operation. Therefore, the project team concluded that there are no applicable aging effects requiring management for plastic and glass components exposed to condensation external and raw water internal environments. Furthermore, the project team also concluded that condenser components fabricated from carbon steel, copper alloy, titanium and elastomer exposed to indoor air, treated water, or steam >270 F environment, there are no aging effects and no aging management program is required to assure the post accident function.

On the basis of its audit and review of the applicant's program, the project team found 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).

3.3.2.3.1 Standby Liquid Control System (SLG) - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-1

The project team reviewed the PNPS LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the standby liquid control system (SLG) component groups.

In LRA Table 3.3.2-1, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.2 <u>Salt Service Water (SSW) Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-2</u>

The project team reviewed the PNPS LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the SSW system component groups.

In LRA Table 3.3.2-2, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.



3.3.2.3.3 <u>Station Blackout Diesel (SBO) System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-5</u>

The project team reviewed the PNPS LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the station blackout diesel (SBO) system component groups.

In the PNPS LRA Table 3.3.2-5, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.4 <u>Security Diesel - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-6</u>

The project team reviewed the PNPS LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the station security diesel system component groups.

In the PNPS LRA Table 3.3.2-6, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.5 Fuel Oil (FO) System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-7

The project team reviewed the PNPS LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the station blackout diesel (SBO) system component groups.

In the PNPS LRA Table 3.3.2-7, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.



3.3.2.3.6 Instrument Air (IA) System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-8

The project team reviewed the PNPS LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the instrument air (IA) system component groups.

In the PNPS LRA Table 3.3.2-8, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.7 Fire Protection - Water System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-9

The project team reviewed the PNPS LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the fire protection - water system component groups.

In the PNPS LRA Table 3.3.2-9, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.8 Fire Protection - Halon System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-10

The project team reviewed the PNPS LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the fire protection - Halon system component groups.

In the PNPS LRA Table 3.3.2-10, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.9 Heating, Ventilation, and Air Conditioning (HVAC) System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-11



The project team reviewed the PNPS LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the heating, ventilation, and air conditioning system component groups.

In the PNPS LRA Table 3.3.2-11, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.10 Primary Containment Atmosphere Control (PCAC) Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-12

The project team reviewed the PNPS LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the primary containment atmospheric control (PCAC) system component groups.

In the PNPS LRA Table 3.3.2-12, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.11 <u>Fuel Pool Cooling (FPC) and Fuel Handling and Storage Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-13</u>

The project team reviewed the PNPS LRA Table 3.3.2-13, which summarizes the results of AMR evaluations for the fuel pool cooling and fuel handling and storage system component groups.

In the PNPS LRA Table 3.3.2-13, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.12 <u>Circulating Water System, Nonsafety-Related Components Affecting Safety-Related Systems (CSA) - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-1</u>

The project team reviewed the PNPS LRA Table 3.3.2-14-1, which summarizes the results of AMR evaluations for the circulating water system, nonsafety-related components affecting safety-related systems (CSA) component groups.

In the PNPS LRA Table 3.3.2-14-1, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.13 Compressed Air System, Nonsafety-Related Components Affecting Safety-Related Systems (CAS)- Summary of Aging Management Evaluation- PNPS LRA Table 3.3.2-14-2

The project team reviewed the PNPS LRA Table 3.3.2-14-2, which summarizes the results of AMR evaluations for the condensate system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-2, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.14 Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-3



The project team reviewed the PNPS LRA Table 3.3.2-14-3, which summarizes the results of AMR evaluations for the condensate system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-3, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.15 Condensate Demineralizer (CDS), Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-4

The project team reviewed the PNPS LRA Table 3.3.2-14-4, which summarizes the results of AMR evaluations for the condensate demineralizer (CDS), nonsafety-related components Affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-4, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.16 <u>Control Rod Drive (CRD) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-6</u>

The project team reviewed the PNPS LRA Table 3.3.2-14-6, which summarizes the results of AMR evaluations for the control rod drive (CRD) system, nonsafety-related components Affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-6, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.17 <u>Core Spray (CS) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-7</u>

The project team reviewed the PNPS LRA Table 3.3.2-14-7, which summarizes the results of AMR evaluations for the core spray (CS) system, nonsafety-related components affecting Safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-7, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.18 <u>Emergency Diesel Generator (EDG) System, Nonsafety-Related Components Affecting Safety-Related Systems- Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-8</u>

The project team reviewed the PNPS LRA Table 3.3.2-14-8, which summarizes the results of AMR evaluations for the emergency diesel generator (EDG) system, nonsafety-related Components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-8, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.19 Fire Protection System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-12

The project team reviewed the PNPS LRA Table 3.3.2-14-12, which summarizes the results of AMR evaluations for the fire protection system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-12, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.20 Fuel Oil (FO) Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-13

The project team reviewed the PNPS LRA Table 3.3.2-14-13, which summarizes the results of AMR evaluations for the fuel oil (fo) storage and transfer system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-13, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.21 Fuel Pool Cooling (FPC) and Demineralizer System, Nonsafety-Related Components Affecting Safety-Related Systems- Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-14

The project team reviewed the PNPS LRA Table 3.3.2-14-14, which summarizes the results of AMR evaluations for the fuel pool cooling (fpc) and demineralizer system, nonsafety-related components affecting safety-related component groups.

In the PNPS LRA Table 3.3.2-14-14, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.22 Heating, Ventilation and Air Conditioning (HVAC) Systems, Nonsafety- Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-15

The project team reviewed the PNPS LRA Table 3.3.2-14-15, which summarizes the results of AMR evaluations for the heating, ventilation and air conditioning (HVAC) systems, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-15, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.23 High Pressure Coolant Injection (HPCI) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-16

The project team reviewed the PNPS LRA Table 3.3.2-14-16, which summarizes the results of AMR evaluations for the high pressure coolant injection (HPIC) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-16, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.24 <u>Offgas and Augmented Offgas (AOG) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-19</u>

The project team reviewed the PNPS LRA Table 3.3.2-14-19, which summarizes the results of AMR evaluations for the offgas and augmented offgas (AOG) system, nonsafety-related Components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-19, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."



The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.25 <u>Post-Accident Sampling (PASS) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-20</u>

The project team reviewed the PNPS LRA Table 3.3.2-14-20, which summarizes the results of AMR evaluations for the post-accident sampling (PASS) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-20, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.26 Potable and Sanitary Water System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-21

The project team reviewed the PNPS LRA Table 3.3.2-14-21, which summarizes the results of AMR evaluations for the potable and sanitary water system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-21, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.27 Primary Containment Atmospheric Control (PCAC) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-22

The project team reviewed the PNPS LRA Table 3.3.2-14-22, which summarizes the results of AMR evaluations for the primary containment atmospheric control (PCAC) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-22, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.28 Radioactive Waste System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-23

The project team reviewed the PNPS LRA Table 3.3.2-14-23, which summarizes the results of AMR evaluations for the radioactive waste system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-23, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.29 Reactor Building Closed Cooling Water (RBCCW) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-24

The project team reviewed the PNPS LRA Table 3.3.2-14-24, which summarizes the results of AMR evaluations for the reactor building closed cooling water (RBCCW) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-24, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."



The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.30 Reactor Core Isolation Cooling (RCIC) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-25

The project team reviewed the PNPS LRA Table 3.3.2-14-25, which summarizes the results of AMR evaluations for the reactor core isolation cooling (RCIC) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-25, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.31 Reactor Coolant (RCS) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-26

The project team reviewed the PNPS LRA Table 3.3.2-14-26, which summarizes the results of AMR evaluations for the reactor coolant (RCS) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-26, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.32 Reactor Water Cleanup (RWCU) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-27



The project team reviewed the PNPS LRA Table 3.3.2-14-27, which summarizes the results of AMR evaluations for the reactor water cleanup (RWCU) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-27, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.33 Reactor Water Cleanup (RWCU) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-28

The project team reviewed the PNPS LRA Table 3.3.2-14-28, which summarizes the results of AMR evaluations for the residual heat removal (RHR) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-28, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.34 Salt Service Water (SSW) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-29

The project team reviewed the PNPS LRA Table 3.3.2-14-29, which summarizes the results of AMR evaluations for the SSW system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-29, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.35 Sampling Systems, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-30

The project team reviewed the PNPS LRA Table 3.3.2-14-30, which summarizes the results of AMR evaluations for the sampling systems, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-30, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.36 Sanitary Soiled Waste and Vent; Plumbing and Drains, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-31

The project team reviewed the PNPS LRA Table 3.3.2-14-31, which summarizes the results of AMR evaluations for the sanitary soiled waste and vent; plumbing and drains, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-31, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.37 Screen Wash System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-32

The project team reviewed the PNPS LRA Table 3.3.2-14-32, which summarizes the results of AMR evaluations for the screen wash system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-32, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.38 Standby Liquid Control (SLC) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-33

The project team reviewed the PNPS LRA Table 3.3.2-14-33, which summarizes the results of AMR evaluations for the Standby liquid control (SLC) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-33, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.39 Turbine Building Closed Cooling Water (TBCCW) System, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-34

The project team reviewed the PNPS LRA Table 3.3.2-14-34, which summarizes the results of AMR evaluations for the Turbine building closed cooling water (TBCCW) system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-34, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

3.3.2.3.40 Turbine Generator and Auxiliaries, Nonsafety-Related Components Affecting Safety-Related Systems - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-35

The project team reviewed the PNPS LRA Table 3.3.2-14-35, which summarizes the results of AMR evaluations for the turbine building generator and auxiliaries system, nonsafety-related components affecting safety-related systems component groups.

In the PNPS LRA Table 3.3.2-14-35, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environmentusing PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed.

Conclusion

On the basis of its review, the project team found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not addressed in the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.3.3 Conclusion

On the basis of its review, the project team concluded that the applicant has demonstrated that the aging effects associated with the auxiliary systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable UFSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the auxiliary systems components, as required by 10 CFR 54.21(d).

### 3.4 Aging Management of Steam and Power Conversion System

This section of the audit and review report document the project team's review and evaluation of PNPS aging management review (AMR) results for the aging management of the steam and power conversion system component and component groups associated with the following systems:

- condensate storage system,
- main steam system,
- turbine-generator and auxiliaries,
- main condenser
- miscellaneous systems in scope for 10 CFR 54.4(a)(2). (These steam and power conversion systems are included by PNPS in LRA Section 3.3, Auxiliary Systems, but are evaluated in this section)

#### 3.4.1 Summary of Technical Information in the Application

In the PNPS LRA Section 3.4, the applicant provided the results of its AMRs for the steam and power conversion system components and component groups.

In PNPS LRA Table 3.4.1, "Summary of Aging Management Program for Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801," the applicant provided a summary comparison of its AMR line-items with the AMR line-items evaluated in the GALL Report for the steam and power conversion system components and component groups. The applicant also identified for each component type in the PNPS LRA Table 3.4.1 those components that are consistent with the GALL Report, those for 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.

In the PNPS LRA Tables 3.4.2-1 and 3.4.2-2, the applicant provided a summary of the AMR results for component types associated with (1) condensate storage system, (2) main steam system, (3) turbine-generator and auxiliaries, and (4) main condenser system.

In the PNPS LRA Tables 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18 and 3.3.2-14-35, the applicant provides results for component types associated with the following Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2):

- Circulating Water System, Nonsafety-Related Components Affecting Safety-Related Systems (CWS)

- Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems

- Condensate Demineralizer System, Nonsafety-Related Components Affecting Safety-Related Systems (CDS)

- Condensate Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems (CST)

- Extraction Steam System, Nonsafety-Related Components Affecting Safety-Related Systems
- Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems
- Feedwater Heater Drains and Vents System, Nonsafety-Related Components Affecting Safety-Related Systems
- Main Condenser System, Nonsafety-Related Components Affecting Safety-Related Systems
- Main Steam System, Nonsafety-Related Components Affecting Safety-Related Systems
- Turbine Generator and Auxiliary System, Nonsafety-Related Components Affecting Safety-Related Systems

Specifically, the information for each component type includes intended function, material, environment, aging effect requiring management, AMPs, the GALL Report Volume 2 item, cross reference to the PNPS LRA Table 3.4.1 (Table 1), and generic and plant-specific notes related to consistency with the GALL Report.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effect requiring managements (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

### 3.4.2 Project Team Evaluation

The project team reviewed PNPS LRA Section 3.4 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team reviewed certain identified AMR line-items to confirm the applicant's claim that these AMR line-items were consistent with the GALL Report. The project team did not repeat its review of the matters described in the GALL Report. However, the project team did verify that the material presented in the PNPS LRA was applicable and that the applicant had identified the appropriate GALL Report AMR line-items. The project team's audit evaluation is documented in Section 3.4.2.1 of this audit and review report. In addition, the project team's evaluations of the AMPs are documented in Section 3.0.3 of this audit and review report.

The project team reviewed those selected AMR line-items for which further evaluation is recommended by the GALL Report. The project team confirmed that the applicant's further evaluations were in accordance with the acceptance criteria in SRP-LR. The project team's audit evaluation is documented in Section 3.4.2.2 of this audit and review report.

The project team also reviewed of the remaining AMR line-items that were not consistent with or not addressed in the GALL Report based on NRC-approved precedents. The audit included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The project team's evaluation is documented in Section 3.4.2.3 of this audit and review report.

Finally, the project team reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the steam and power conversion system components.

Table 3.4-1 below provides a summary of the project team's evaluation of components, aging effects/aging mechanisms, and AMPs listed in LRA Section 3.1 that are addressed in the GALL Report. It also includes the section of the audit and review report in which the project team's evaluation is documented.

**Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL Report**

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.4.1-1 | Steel piping, piping components, and piping elements exposed to steam or treated water | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | | |
| 3.4.1-2 | Steel piping, piping components, and piping elements exposed to steam | Loss of material due to general, pitting and crevice corrosion. | Water Chemistry and One-Time Inspection | | |
| 3.4.1-3 | PWR Only | | | | |
| 3.4.1-4 | Steel piping, piping components, and piping elements exposed to treated water | Loss of material due to general, pitting and crevice corrosion | Water Chemistry and One-Time Inspection | | |
| 3.4.1-5 | Steel heat exchanger components exposed to treated water | Loss of material due to general, pitting, crevice, and galvanic corrosion | Water Chemistry and One-Time Inspection | | |
| 3.4.1-6 | Steel and stainless steel tanks exposed to treated water | Loss of material due to general (steel only) pitting and crevice corrosion | Water Chemistry and One-Time Inspection | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.4.1-7 | Steel piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to general, pitting and crevice corrosion | Lubricating Oil Analysis and One-Time Inspection | | |
| 2 | 3.4.1-8 | Steel piping, piping components, and piping elements exposed to raw water | Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling | Plant specific | | |
| 3 | 3.4.1-9 | Stainless steel and copper alloy heat exchanger tubes exposed to treated water | Reduction of heat transfer due to fouling | Water Chemistry and One-Time Inspection | | |
| 4 | 3.4.1-10 | Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil | Reduction of heat transfer due to fouling | Lubricating Oil Analysis and One-Time Inspection | | |
| 5 | 3.4.1-11 | Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil | Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion | Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection | | |
| 6 | 3.4.1-12 | Steel heat exchanger components exposed to lubricating oil | Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion | Lubricating Oil Analysis and One-Time Inspection | | |
| 7 | 3.4.1-13 | Stainless steel piping, piping components, piping elements exposed to steam | Cracking due to stress corrosion cracking | Water Chemistry and One-Time Inspection | | |
| 8 | 3.4.1-14 | Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water >60°C (>140°F) | Cracking due to stress corrosion cracking | Water Chemistry and One-Time Inspection | | |
| 9 | 3.4.1-15 | Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspection | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.4.1-16 | Stainless steel piping, piping components, and piping elements; tanks, and heat exchanger compone nts exposed to treated water | Loss of material due to pitting and crevice corrosion | Water Chemistry and One-Time Inspecti on | | |
| 2 | 3.4.1-17 | Stain less steel piping, piping components, and piping elements exposed to soil | Loss of material due to pitting and crevice corrosion | Plant specific | | |
| 3 | 3.4.1-18 | Copper alloy piping, piping components , and piping elements exposed to lubricating oil | Loss of material due to pitting and crevice corrosion | Lubrica ting Oil Analysis and One-Time Inspe ction | | |
| 4 | 3.4.1-19 | Stainless steel piping, piping components, piping elements, and heat exchanger components expose d to lubricating oil | Loss of material due to pitting, crevi ce, and microbiologic ally-influenced corrosion | Lubricat ing Oil Analysis and One-Time Inspe ction | | |
| 5 | 3.4.1-20 | Steel tanks exposed to air - outdoor (external) | Loss of material/ gene ral, pitting, and crevice corrosion | Aboveground Steel Tanks | | |
| 6 | 3.4.1-21 | High-strength steel closure bolting exposed to air with steam or water leakage | Cracking due to cyclic loading, stress corrosion crackin g | Bolting Integrity | | |
| 7 | 3.4.1-2 2 | Steel bolting and closure bolting exposed to air with steam or water leakage, air - outdoor (external), or air - indoor uncontrolled (external); | Loss of material due to general, pitti ng and crevice corrosion ; loss of preload due to thermal effects, gasket creep, and self-loosenin g | Bolting Integrity | | |
| 8 | 3.4.1-2 3 | Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water > 60°C (> 140°F) | Crackin g due to stress corrosion crackin g | Closed-Cycle Coo ling Water System | | |
| 9 | 3.4.1 -24 | Steel heat exchanger compone nts exposed to closed cycle cooling water | Loss of material due to general, pitti ng, crevice, and galvanic corrosion | Closed- Cycle Cooling Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.4.1-25 | Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water | Loss of material due to pitting and crevice corrosion | Closed-Cycle Cooling Water System | | |
| 2 | 3.4.1-26 | Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water | Loss of material due to pitting, crevice, and galvanic corrosion | Closed-Cycle Cooling Water System | | |
| 3 | 3.4.1-27 | Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water | Reduction of heat transfer due to fouling | Closed-Cycle Cooling Water System | | |
| 4 | 3.4.1-28 | Steel external surfaces exposed to air - indoor uncontrolled (external), condensation (external), or air outdoor (external) | Loss of material due to general corrosion | External Surfaces Monitoring | | |
| 5 | 3.4.1-29 | Steel piping, piping components, and piping elements exposed to steam or treated water | Wall thinning due to flow-accelerated corrosion | Flow-Accelerated Corrosion | | |
| 6 | 3.4.1-30 | Steel piping, piping components, and piping elements exposed to air outdoor (internal) or condensation (internal) | Loss of material due to general, pitting, and crevice corrosion | Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components | | |
| 7 | 3.4.1-31 | Steel heat exchanger components exposed to raw water | Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 8 | 3.4.1-32 | Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting, crevice, and microbiologically-influenced corrosion | Open-Cycle Cooling Water System | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.4.1-33 | Stainless steel heat exchanger components exposed to raw water | Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling | Open-Cycle Cooling Water System | | |
| 2 | 3.4.1-34 | Steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water | Reduction of heat transfer due to fouling | Open-Cycle Cooling Water System | | |
| 3 | 3.4.1-35 | Copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water | Loss of material due to selective leaching | Selective Leaching of Materials | | |
| 4 | 3.4.1-36 | Gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water | Loss of material due to selective leaching | Selective Leaching of Materials | | |
| 5 | 3.4.1-37 | Steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam | Loss of material due to pitting and crevice corrosion | Water Chemistry | | |
| 6 | 3.4.1-38 | PWR Only | | | | |
| 7 | 3.4.1-39 | PWR Only | | | | |
| 8 | 3.4.1-40 | Glass piping elements exposed to air, lubricating oil, raw water, and treated water | None | None | | |
| 9 | 3.4.1-41 | Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) | None | None | | |
| 10 | 3.4.1-42 | Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) | None | None | | |
| 11 | 3.4.1-43 | Steel and stainless steel piping, piping components, and piping elements in concrete | None | None | | |

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| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.4.1-44 | Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas | None | None | | |

### 3.4.2.1 AMR Results That Are Consistent with The GALL Report

<u>Summary of Information in the Application</u>

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 PNPS LRA is acceptable.

In PNPS LRA Section 3.4.1.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the condensate storage system, main steam system, turbine-generator and auxiliaries, and main condenser system:

- Buried Piping and Tank Inspection Program (B.1.1)
- Flow Accelerated Corrosion Program (B.1.14)
- Periodic Surveillance and Preventive Maintenance Program (B.1.24)
- Selective Leaching Program (B.1.27)
- System Walkdown Program (B.1.31)
- Water Chemistry Control - BWR Program (B.1.32.3)

<u>Project Team Evaluation</u>

The project team reviewed its assigned PNPS LRA AMR 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 condensate system, condensate transfer system, feedwater system, main condenser, main generator and auxiliary system, main steam system, and main turbine and auxiliary system components that are subject to an AMR.

This section addresses consistency with the GALL Report. For each Tables 1 entry for which no further evaluation is required by the SRP-LR and the project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicant's basis for why it is acceptable. Identify documents reviewed, full title, revision, and/or date of issue, and the reviewer's basis for accepting the differences. If additional information is requested from the applicant to develop an acceptable reviewer finding, cite the applicant's docketed letter, commitment or other docketed LRA supplement. The docketed item is to be cited by title, date and ADAMs accession number. Use Template 5 below for this purpose. There is to be a separate, numbered section for each aging effect in Table 1 that is to be discussed. Otherwise there is no need to discuss that particular Table 1 entry]

[This section also addresses Table 2 regarding consistency with the GALL Report when project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicants basis for why it is acceptable (for example, a different Note is used). This section also addresses Note E and why using an AMP that is different than that recommended in GALL Report is acceptable (see Example 13 at the end of this document)]

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**Template 5 -** **Aging Management Reviews Results That Are Consistent With the GALL Report – With Identified Difference/Issue**

3.[Y].2.1.S] Title of Aging Effect/Mechanism

In the discussion section of Table 3.Y.1, Item [NUMBER]of the PNPS LRA, the applicant stated that [provide description of in the LRA]. During the audit and review, the project team noted that [provide description of differences, the applicant's basis.]

[ Identify documents reviewed and basis for acceptability, project team evaluation]

On the basis of its review, the project team found that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.



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Conclusion

The project team has evaluated the applicant's claim of consistency with the GALL Report. The project team also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the project team found that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team found that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.4.2.2 AMR Results For Which Further Evaluation Is Recommended By The GALL Report

Summary of Information in the Application

In PNPS LRA Section 3.4.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the condensate system, condensate transfer system, feedwater system, main condenser, main generator and auxiliary system, main steam system, and main turbine and auxiliary system components and component groups. The applicant also provided information concerning how it will manage the related aging effects.

Project Team Evaluation

For some AMR line-items assigned to the project team in the PNPS LRA Tables 3.4.1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNPS LRA Section 3.4.2.2 against the criteria provided in the SRP-LR Section 3.4.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 AMR line-item in Section 3.4 citing the item in Table 1.

3.4.2.2.1 Cumulative Fatigue Damage

In the PNPS LRA Section 3.4.2.2.1, the applicant states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). The project team's evaluation of this TLAA is addressed separately in Section 4 of the SER related to the PNPS LRA.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

3.4.2.2.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.4.2.2.2.1 against the criteria in SRP-LR Section 3.4.2.2.2.1.

SRP-LR Section 3.4.2.2.2.1 states that the loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control 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 the PNPS LRA Section 3.4.2.2.2.1, the applicant states that, at PNPS, there are no heat exchanger components included in the steam and power conversion systems except for components in scope solely based on criterion 10 CFR 54.4(a)(2). The condensers are included as part of the main condenser and MSIV leakage pathway but have no aging effects requiring management since their intended function is for holdup and plate-out of radioactive materials.

Additionally, the loss of material due to general, pitting and crevice corrosion for carbon steel iping, piping components, and tanks, exposed to treated water and for carbon steel piping and components exposed to steam is an aging effect requiring management in the steam and power conversion systems at PNPS, and is managed by the Water Chemistry Control – BWR and Periodic Surveillance and Preventive Maintenance (PSPM) Programs. The effectiveness of the water chemistry control-BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow. The PSPM Program uses visual inspections and other NDE techniques to manage loss of material for carbon steel tanks in the condensate storage system.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2.1 for further evaluation. The project team found 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).

3.4.2.2.2.2 <u>Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 2]</u>

The project team reviewed PNPS LRA Section 3.4.2.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2.2.



SRP-LR Section 3.4.2.2.2.2 states that a loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.2.2, the applicant states that a loss of material due to general, pitting and crevice corrosion for steel piping and components in steam and power conversion systems exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect only applies to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) (see Table 3.3.2-14-35). The Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2.2 for further evaluation. The project team found 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).

3.4.2.2.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion (MIC), and Fouling

The project team reviewed PNPS LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3.

SRP-LR Section 3.4.2.2.3 states that a loss of material due to general, pitting, crevice, and MIC, and fouling could occur in steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

In the PNPS LRA Section 3.4.2.2.3, the applicant states that a loss of material due to general, pitting, crevice, and MIC, and fouling in steel piping, piping components, and piping elements exposed to raw water is managed by the Periodic Surveillance and Preventive Maintenance (PSPM) Program. The PSPM Program uses visual inspections and other NDE techniques to manage loss of material for carbon steel components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.3 for further evaluation. The project team found 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).

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

3.4.2.2.4.1 Reduction of Heat Transfer Due to Fouling [Item 1]

The project team reviewed PNPS LRA Section 3.4.2.2.4.1 against the criteria in SRP-LR Section 3.4.2.2.4.1.

SRP-LR Section 3.4.2.2.4.1 states that the reduction of heat transfer due to fouling could occur for stainless steel and copper alloy heat exchanger tubes exposed to treated water. The existing aging management program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may not always have been adequate to preclude fouling. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.4.1, the applicant states that the steam and power conversion systems at PNPS have no heat exchanger tubes with an intended function of heat transfer and associated aging effect of fouling. However, reduction of heat transfer is managed by the Water Chemistry Control – BWR Program for copper alloy heat exchanger tubes in the high pressure coolant injection and reactor core isolation cooling systems. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.4.1 for further evaluation. The project team found 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).

3.4.2.2.4.2 <u>Reduction of Heat Transfer Due to Fouling [Item 2]</u>



The project team reviewed PNPS LRA Section 3.4.2.2.4.2 against the criteria in SRP-LR Section 3.4.2.2.4.2.

SRP-LR Section 3.4.2.2.4.2 states that the reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing aging management program relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that fouling is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil 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 the PNPS LRA Section 3.4.2.2.4.2, the applicant states that the steam and power conversion systems at PNPS have no heat exchanger tubes with an intended function of heat transfer and associated aging effect of fouling. However, reduction of heat transfer is managed by the Oil Analysis Program for steel heat exchanger tubes in the station blackout diesel generator and security diesel generator systems. The Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to fouling. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that fouling has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.4.2 for further evaluation. The project team found 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).

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

3.4.2.2.5.1 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.4.2.2.5.1 against the criteria in SRP-LR Section 3.4.2.2.5.1.

SRP-LR Section 3.4.2.2.5.1 states that the Loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general corrosion, 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 the PNPS LRA Section 3.4.2.2.5.1, the applicant states that the steam and power conversion systems at PNPS have no carbon steel components that are exposed to soil. This item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.5.1 for further evaluation. The project team found 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).

3.4.2.2.5.2 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion [Item 2]

The project team reviewed PNPS LRA Section 3.4.2.2.5.2 against the criteria in SRP-LR Section 3.4.2.2.5.2.

SRP-LR Section 3.4.2.2.5.2 states that the loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.5.2, the applicant states that the steam and power conversion systems at PNPS have no heat exchanger components that are exposed to lubricating oil. This item is not applicable to PNPS.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.5.2 for further evaluation. The project team found 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).



3.4.2.2.6 Cracking Due to Stress Corrosion Cracking

The project team reviewed PNPS LRA Section 3.4.2.2.6 against the criteria in SRP-LR Section 3.4.2.2.6

SRP-LR Section 3.4.2.2.6 states that cracking due to SCC could occur in the stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60°C (>140°F), and for stainless steel piping, piping components, and piping elements exposed to steam. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.6, the applicant states that cracking due to SCC in stainless steel components exposed to steam is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.6 for further evaluation. The project team found 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).

3.4.2.2.7 Loss of Material Due to Pitting and Crevice Corrosion

3.4.2.2.7.1 Loss of Material Due to Pitting and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.4.2.2.7.1 against the criteria in SRP-LR Section 3.4.2.2.7.1.

SRP-LR Section 3.4.2.2.7.1 states that a loss of material due to pitting and crevice corrosion could occur for stainless steel, aluminum, and copper alloy piping, piping components and piping elements and for stainless steel tanks and heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to pitting, and crevice corrosion. However, control of water chemistry does not preclude corrosion at locations of stagnant flow conditions. Therefore, the GALL Report recommends that the effectiveness of the water chemistry program should be verified to ensure that corrosion is not occurring. 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 the PNPS LRA Section 3.4.2.2.7.1, the applicant states that the loss of material due to pitting and crevice corrosion for stainless steel and copper alloy components exposed to treated water is managed by the Water Chemistry Control – BWR Program. There are no aluminum components in the steam and power conversion systems. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.1 for further evaluation. The project team found 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).

3.4.2.2.7.2 Loss of Material Due to Pitting and Crevice Corrosion [Item 2]

The project team reviewed PNPS LRA Section 3.4.2.2.7.2 against the criteria in SRP-LR Section 3.4.2.2.7.2.

SRP-LR Section 3.4.2.2.7.2 states that a loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific aging management to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

In the PNPS LRA Section 3.4.2.2.7.2, the applicant states that the loss of material due to pitting and crevice corrosion for stainless steel piping and tubing exposed to soil is managed by the Buried Piping and Tanks Inspection Program. This program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried components. Buried components will be inspected when excavated during maintenance. An inspection will be performed within 10 years of entering the period of extended operation, unless an opportunistic inspection occurred within this ten-year period. This program will manage the aging effect of loss of material such that the intended function of the components will not be affected.

[ Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.2 for further evaluation. The project team found 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).



3.4.2.2.7.3 Loss of Material Due to Pitting and Crevice Corrosion [Item 3]

The project team reviewed PNPS LRA Section 3.4.2.2.7.3 against the criteria in SRP-LR Section 3.4.2.2.7.3.

SRP-LR Section 3.4.2.2.7.3 states that the Loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.7.3, the applicant states that Loss of material due to pitting and crevice corrosion for copper alloy components in steam and power conversion systems exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect only applies to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) (see

Table 3.3.2-14-35). The Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.3 for further evaluation. The project team found 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).

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The project team reviewed PNPS LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8.

SRP-LR Section 3.4.2.2.8 states that the Loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.8, the applicant states that a loss of material due to pitting, crevice, and MIC for stainless steel components in steam and power conversion systems exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect only applies to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) (see Table 3.3.2-14-35). The Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.8 for further evaluation. The project team found 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).

3.4.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

The project team reviewed PNPS LRA Section 3.4.2.2.9 against the criteria in SRP-LR Section 3.4.2.2.9.

SRP-LR Section 3.4.2.2.9 states that a loss of material due to general, pitting, crevice, and galvanic corrosion can occur for steel heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control 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. Acceptance criteria are described in Branch Technical Position IQMB-1.

In the PNPS LRA Section 3.4.2.2.9, the applicant states that a loss of material due to general, pitting, crevice, and galvanic corrosion for steel heat exchanger components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.9 for further evaluation. The project team found 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).

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

PNPS LRA Section 3.4.2.2.10 is reviewed by NRR DE staff and will be addressed separately in Section 3 of the SER related to the PNPS LRA.

In the PNPS LRA Section 3.4.2.2.10 the applicant states that PNPS quality assurance procedures and administrative controls for aging management programs are discussed in Appendix B, Section B.0.3 of the PNPS LRA.

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 determined that the applicant adequately addressed the issues that were further evaluated. The project team found 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).

### 3.4.2.3 AMR Results That Are Not Consistent With The GALL Report Or Not Addressed In The GALL Report

Summary of Information in the Application

In PNPS LRA Table 3.4.1, Summary of Aging Management Evaluations for the Steam and Power Conversion System, the applicant provides information regarding components or material/environment combination in the GALL Report that it evaluated and identified as not applicable to its plant.

In PNPS LRA Tables 3.4.2-1 and 3.4.2-2, the applicant provides additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report. Specifically, the applicant indicates, via Notes F through J, that neither the identified component nor the material / environment combination is evaluated in the GALL Report and provided information concerning how the aging effect requiring management will be managed.



Project Team Evaluation

The project team reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

Aging Effect/Mechanism in Table 3.4.1 That Are Not Applicable for PNPS

[This section is for write-up of the AMR line-items that the applicant claims are not used or not applicable to its plant in LRA Table 3.4.1. The write-up does not include the "further evaluation required" in Table 1 since they are evaluated in Section 3.4.2.2. In addition, the evaluation is not necessary if the plant is of a different vintage (PWR vs. BWR)]

In PNPS LRA Table 3.4.1, Item 3.4.1-21 discussion column the applicant states that cracking due to cyclic loading, stress corrosion cracking of the high-strength steel closure bolting exposed to air with steam or water leakage is not applicable to PNPS because high-strength steel closure bolting is not used in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

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In PNPS LRA Table 3.4.1, Item 3.4.1-23 discussion column the applicant states that cracking due to stress corrosion cracking of stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (>140°F) is not applicable to PNPS because there are no stainless steel components exposed to closed-cycle cooling water in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-24 discussion column the applicant states that the loss of material due to general, pitting, crevice, and galvanic corrosion of steel heat exchanger components exposed to closed cycle cooling water is not applicable to PNPS because there are no steel heat exchanger components exposed to closed cycle cooling water in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.



In PNPS Table 3.4.1, Item 3.4.1-25 discussion column the applicant states that the loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, piping elements, and hear exchanger components exposed to closed cycle cooling water is not applicable to PNPS because there are no stainless steel components exposed to closed cycle cooling water in the steam and power conversion system.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-26 discussion column the applicant states that the loss of material due to pitting, crevice, and galvanic corrosion of copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water is not applicable to PNPS because there are no copper alloy components exposed to closed cycle cooling water in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-27 discussion column the applicant states that the reduction of heat transfer due to fouling of steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water is not applicable to PNPS because there are no heat exchanger tubes exposed to closed cycle cooling water in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-33 discussion column, the applicant states that the loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling of stainless steel heat exchanger components exposed to raw water is not applicable to PNPS because there are no stainless steel heat exchanger components exposed to raw water in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.



In PNPS Table 3.4.1, Item 3.4.1-34 discussion column the applicant states that the reduction of heat transfer due to fouling of steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water is not applicable to PNPS because there are no heat exchanger tubes exposed to raw water with an intended function of heat transfer in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-42 discussion column the applicant states that the aging of steel piping, piping components, and piping elements exposed to controlled indoor air is not applicable to PNPS because there are no steel components exposed to controlled indoor air in the steam and power systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-43 discussion column the applicant states that the aging of steel and stainless steel piping, piping components, and piping elements in concrete is not applicable to PNPS because there are no steel or stainless steel components exposed to concrete in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-44 discussion column the applicant states that the aging of steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas is not applicable to PNPS because there are no steel, stainless steel. aluminum, or copper alloy components exposed to gas in the steam and power conversion systems.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.



[Repeat the above three paragraphs, if applicable, for all items that the applicant claims is not applicable to its plant]

[If there are RAIs or issues that affect all Tables, provide discussion and evaluation here]

[If the LRA lists a series of components which have no aging effect and therefore do not require aging management, the following writeup may be used, as appropriate.]

<u>Steam and Power Conversion System AMR Line Items That Have No Aging Effect (PNPS LRA Tables 3.4.2-1, 3.4.2-2, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18 and 3.3.2-14-35)</u>

In PNPS LRA Tables 3.4.2-1, 3.4.2-2, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18 and 3.3.2-14-35, the applicant identified AMR line-items where no aging effects were identified as a result of its aging review process. Specific instances in which the applicant states that no aging effects were identified occurred in the following areas:

<u>Condenser components fabricated from carbon steel, copper alloy, titanium and elastomer exposed to indoor air, treated water, or steam >270°F</u>.

PNPS stated that aging management of the main condenser is not based on analysis of materials, environments and aging effects. Condenser integrity required to perform the post-accident intended function (holdup and plateout of MSIV leakage) is continuously confirmed by normal plant operation. This intended function does not require the condenser to be leak-tight, and the post accident conditions in the condenser will be essentially atmospheric. Since normal plant operation assures adequate condenser pressure boundary integrity, the post-accident intended function to provide holdup volume and plateout surface is assured. Based on past precedence (NUREG-1796, Dresden and Quad Cities SER, Section 3.4.2.4.4, and NUREG-1769, Peach Bottom SER, Section 3.4.2.3), the staff concluded that main condenser integrity is continually verified during normal plant operation and no aging management program is required to assure the post-accident intended function.

The project team reviewed the past precedents and concluded that PNPS has similar intended function for the main condenser and therefore, no aging management program is required to assure the post accident function.

Glass in condensation external environment

Glass as a material is impervious to normal plant environments. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation.

Plastic in various environments **(Need to ask PNPS what plastic material they are using)**

PVC is unaffected by water, concentrated alkalies, and non-oxidizing acids, oils and ozone. PVC is also unaffected by sunlight and humidity changes.



Unlike metals, thermoplastics do not display corrosion rates. Rather than depending on an oxide layer for protection, they depend on chemical resistance to the environment to which they are exposed. The use of thermoplastics in a water environment is a design driven criteria. Therefore based on industry experience review and the assumption of proper design and application of the material, aging of thermoplastics in treated water, raw water, and fuel oil environment is not an applicable aging effect.

On the basis of its review of current industry research and operating experience, the project team found that condensation external and raw water internal environments, on plastic and glass will not result in aging that will be of concern during the period of extended operation. Therefore, the project team concluded that there are no applicable aging effects requiring management for plastic and glass components exposed to condensation external and raw water internal environments. Furthermore, the project team also concluded that condenser components fabricated from carbon steel, copper alloy, titanium and elastomer exposed to indoor air, treated water, or steam >270°F environment, there are no aging effects and no aging management program is required to assure the post accident function. .

On the basis of its audit and review of the applicant's program, the project team found 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).

3.4.2.3.1 <u>Condensate Storage System- Summary of Aging Management Evaluation - PNPS LRA Table 3.4.2-1</u>

The project team reviewed the PNPS LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the Condensate storage system component groups.

3.4.2.3.2 <u>Main Condenser and MSIV Leakage Pathway - Summary of Aging Management Evaluation - PNPS LRA Table 3.4.2-2</u>

The project team reviewed the PNPS LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the main condenser and MSIV leakage pathway component groups.

In LRA Table 3.4.2-2, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER]" [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.4.2.3.3 <u>Circulating Water System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-1</u>

The project team reviewed the PNPS LRA Table 3.4.2-14-1, which summarizes the results of AMR evaluations for the circulating water non-safety related component groups affecting safety-related systems.

In LRA Table 3.4.2-14-1, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPS AMP B [NUMBER, " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [list materials] material exposed to [list environments] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.4.2.3.4 <u>Condensate System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-3</u>

The project team reviewed PNPS LRA Table 3.3.2-14-3, which summarizes the results of AMR evaluations for the condensate system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.5 Condensate Demineralizer System - Summary of Aging Management Evaluation - PNPS]LRA Table 3.3.2-14-4

The project team reviewed PNPS LRA Table 3.3.2-14-4, which summarizes the results of AMR evaluations for the condensate demineralizer system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.6 Condensate Storage and Transfer System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-5

The project team reviewed PNPS LRA Table 3.3.2-14-5, which summarizes the results of AMR evaluations for the condensate storage and transfer system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.7 Extraction Steam System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-9



The project team reviewed the PNPS LRA Table 3.4.2-14-9, which summarizes the results of AMR evaluations for the extraction steam non-safety related component groups affecting safety-related systems.

In LRA Table 3.4.2-14-9, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPS AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [list materials] material exposed to [list environments] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.4.2.3.8 Feedwater System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-10

The project team reviewed PNPS LRA Table 3.3.2-14-10, which summarizes the results of AMR evaluations for the feedwater system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.9 Feedwater Heater Drains and Vents System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-11

The project team reviewed PNPS LRA Table 3.3.2-14-11, which summarizes the results of AMR evaluations for the feedwater heater drains and vents system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.10 Main Condenser - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-17

The project team reviewed the PNPS LRA Table 3.4.2-14-17, which summarizes the results of AMR evaluations for the main condenser non-safety related component groups affecting safety-related systems.

In LRA Table 3.4.2-14-17, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPS AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [list materials] material exposed to [list environments] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.4.2.3.11 Main Steam System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-18

The project team reviewed the PNPS LRA Table 3.4.2-14-18, which summarizes the results of AMR evaluations for the main steam system non-safety related component groups affecting safety-related systems.

In LRA Table 3.4.2-14-18, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPS AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [list materials] material exposed to [list environments] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.4.2.3.12 Turbine Generator and Auxiliary System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-35

The project team reviewed the PNPS LRA Table 3.4.2-14-35, which summarizes the results of AMR evaluations for the turbine generator and auxiliary system non-safety related component groups affecting safety-related systems.

In LRA Table 3.4.2-14-35, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPS AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [list materials] material exposed to [list environments] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

Conclusion

On the basis of its review, the project team found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not addressed in the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.4.3 Conclusion

On the basis of its review, the project team concluded that the applicant has demonstrated that the aging effects associated with the steam and power conversion system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable UFSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the steam and power conversion components, as required by 10 CFR 54.21(d).

## 3.5 Aging Management of Structures and Component Supports

This section of the audit and review report document the project team's review and evaluation of PNPS aging management review (AMR) results for the aging management of the structural components and commodities associated with the following systems:

- primary containment,
- reactor building,
- intake structure,
- process facilities,
- yard structures, and
- bulk commodities.

### 3.5.1 Summary of Technical Information in the Application

In the PNPS LRA Section 3.5, the applicant provided the results of its AMRs for the engineered safety features components and component groups.

In PNPS LRA Table 3.5.1, "Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801," the applicant provided a summary comparison of its AMR line-items with the AMR line-items evaluated in the GALL Report for the primary containment, structures, component supports, and piping and component insulation components and component groups. The applicant also identified for each component type in the PNPS LRA Table 3.5.1 those components that are consistent with the GALL Report, those for 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.

In the PNPS LRA Tables 3.5.2-1 through 3.5.2-6, the applicant provided a summary of the AMR results for component types associated with (1) primary containment, (2) reactor building, (3) intake structure, (4) process facilities, (5) yard structures, and (6) bulk commodities. Specifically, the 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 PNPS LRA Table 3.5.1 (Table 1), and generic and plant-specific notes related to consistency with the GALL Report.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effect requiring managements (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

### 3.5.2 Project Team Evaluation

The project team reviewed PNPS LRA Section 3.5 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the primary containment, structures, component supports, and piping and component insulation components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team reviewed certain identified AMR line-items to confirm the applicant's claim that these AMR line-items were consistent with the GALL Report. The project team did not repeat its review of the matters described in the GALL Report. However, the project team did verify that the material presented in the PNPS LRA was applicable and that the applicant had identified the appropriate GALL Report AMR line-items. The project team's audit evaluation is documented in Section 3.5.2.1 of this audit and review report. In addition, the project team's evaluations of the AMPs are documented in Section 3.0.3 of this audit and review report.

The project team reviewed those selected AMR line-items for which further evaluation is recommended by the GALL Report. The project team confirmed that the applicant's further evaluations were in accordance with the acceptance criteria in SRP-LR. The project team's audit evaluation is documented in Section 3.5.2.2 of this audit and review report.

The project team also reviewed of the remaining AMR line-items that were not consistent with or not addressed in the GALL Report based on NRC-approved precedents. The audit included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The project team's evaluation is documented in Section 3.5.2.3 of this audit and review report.

Finally, the project team reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the primary containment, structures, component supports, and piping and component insulation components.

Table 3.5-1 below provides a summary of the project team's evaluation of components, aging effects/aging mechanisms, and AMPs listed in LRA Section 3.5 that are addressed in the GALL Report. It also includes the section of the audit and review report in which the project team's evaluation is documented.

**Table 3.5-1 Staff Evaluation for Containment, Structures, Component Supports, and Piping and Component Insulation in the GALL Report**

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment | | | | | |

| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-1 | Concrete elements: walls, dome, basemat, ring girder, buttresse s, containment (as applicable). | Aging of accessible and inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel | ISI (IWL) and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater if environment is non-aggressiv e. A plant specific program is to be evaluated if environment is aggressive. | | Cons istent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |
| 2 | 3.5.1-2 | Concrete elements; All | Cracks and distortion due to increased stress levels from settlement | Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-waterin g system through the period of extended operation. | | Consis tent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |
| 3 | 3.5.1-3 | Concrete elements: founda tion, sub-foundation | Reduction in foundation stre ngth, cracking, differential settle ment due to erosion of porous concret e subfoundation | Structures Monitoring Progra m If a de-watering sys tem is relied upon to control erosion of cement from porous concrete subfoundations, then the licensee is to ensure proper functioning of the de-waterin g system through the period of extended operation. | | Consis tent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |
| 4 | 3.5.1-4 | Concrete elements: dome, wall, basemat, ring girder, buttresse s, containment, concrete fill-in annulus (as applicable) | Red uction of strength and modulus of concrete due to elevated temper ature | A plant-specific aging management program is to be evaluated. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-5 | Steel elements: Drywell ; torus; drywell head; embedded shell and sand pocket regions; drywell support skirt; torus ring girder; downcomer s; liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor, suppressio n chamber (as applicable) | Loss of material due to general, pitti ng and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |
| 2 | 3.5.1-6 | Steel elements: steel liner, liner anchors, integral attachme nts | Loss of material due to general, pitti ng and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |
| 3 | 3.5.1-7 | Prestre ssed containment tendons | Loss of prestress due to relaxation, sh rinkage, creep, and elevated temperat ure | TLAA, evaluated in accordance with 10 CFR 54.21(c) | | Consiste nt with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |
| 4 | 3.5.1-8 | Steel and stainless steel elements: vent line, vent header, vent line bellows; down comers; | Cumulativ e fatigue damage (CLB fatigue analysis exists) | TLAA, evaluated in accordance with 10 CFR 54.21(c) | | Consiste nt with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-9 | Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers | Cumulative fatigue damage (CLB fatigue analysis exists) | TLAA, evaluated in accordance with 10 CFR 54.21(c) | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1) |
| 2 | 3.5.1-10 | Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds | Cracking due to stress corrosion cracking | ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examinations/ evaluations for bellows assemblies and dissimilar metal welds. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1) |
| 3 | 3.5.1-11 | Stainless steel vent line bellows | Cracking due to stress corrosion cracking | ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examination/ evaluation for bellows assemblies and dissimilar metal welds. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1) |
| 4 | 3.5.1-12 | Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers | Cracking due to cyclic loading | ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1) |
| 5 | 3.5.1-13 | Steel, stainless steel elements, dissimilar metal welds: torus; vent line; vent header; vent line bellows; downcomers | Cracking due to cyclic loading | ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-14 | Concrete elements: dome, wall, basemat ring girder, buttresse s, containment (as applicable) | Loss of material (Scal ing, cracking, and spalling) due to freeze-thaw | ISI (IWL). Evaluation is needed for plants that are located in moderate to severe weathering condit ions (weathering index > 100 day-inch/yr) (NUREG-1557). | | Con sistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |
| 2 | 3.5.1-15 | Concre te elements: walls, dome, basemat, ring girder, buttresse s, containment, concrete fill-in annulus (as applicable). | Crac king due to expansion and reaction with aggregate; in crease in porosity, perme ability due to leaching of calcium hydroxide | ISI (IWL) for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendatio ns in ACI 201.2R. | | Consisten t with GALL, which recommends further evaluation (See SER Section 3.5.2.2.1 ) |
| 3 | 3.5.1-16 | Seals, gaskets, and moisture barriers | Loss of sealing and leakage through co ntainment due to deterioration of joint seals, gaskets, and moisture barriers (caulkin g, flashing, and other sealants) | ISI (IWE) and 10 CFR Part 50, Appendix J | | Consistent with GALL (See SER Section 3.5.2.1) |
| 4 | 3.5.1-17 | Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanism s | Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanism s | 10 CFR Part 50, Appendix J and Plant Technical Specifications | | Co nsistent with GALL (See SER Section 3.5.2.1) |
| 5 | 3.5.1-18 | Steel penetration sleev es and dissimilar metal welds; personnel airlock, equipment hatch and CRD hatch | Loss of material due to general, pitti ng, and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | | Consistent with GALL (See SER Section 3.5.2.1) |
| 6 | 3.5.1-19 | Steel elements: stainle ss steel suppress ion chamber shell (inner surface) | Cracking due to stress corrosion crackin g | ISI (IWE) and 10 CFR Part 50, Appendix J | | Consistent with GALL (See SER Section 3.5.2.1) |

| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-20 | Steel elements: suppres sion chamber liner (interior surface) | Loss of material due to general, pitti ng, and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | | Consistent with GALL (See SER Section 3.5.2.1) |
| 2 | 3.5.1-21 | Steel elements: drywell head and downcomer pipe s | Fretting or lock up due to mechanical wear | ISI (IWE) | | Consistent with GALL (See SER Section 3.5.2.1) |
| 3 | 3.5.1-22 | Prestressed containment tendons and anchorage comp onents | Loss of material due to corrosion | ISI (IWL) | | Consistent with GALL (See SER Section 3.5.2.1) |
| 4 | **Safety-Related and Other Structures; and Component Supports** | | | | | |
| 5 | 3.5.1-2 3 | All Groups except Group 6: interior and above grade exterior concrete | Cracking , loss of bond, and loss of material (spalling, scalin g) due to corrosion of embedded steel | Structures Monitoring Progra m | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2 ) |
| 6 | 3.5.1-24 | All Groups except Group 6: interior and above grade exterior concrete | Increase in porosity and permeability, cracking, loss of material (spalling, scalin g) due to aggressive chem ical attack | Structures Monitoring Program | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2 ) |
| 7 | 3.5.1-25 | All Groups except Group 6: steel component s: all structural steel | Loss of material due to corrosion | Stru ctures Monitoring Program. If protective coatin gs are relied upon to manage the effects of aging, the structures monito ring program is to include provisions to address protective coatin g monitoring and maintenance. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2 ) |
| 8 | 3.5.1-26 | All Groups except Group 6: accessible and inaccessible concrete: foundati on | Loss of material (spal ling, scaling) and cracking due to freeze-thaw | Struc tures Monitoring Progra m. Evaluation is needed for plants that are located in moderate to severe weathering condit ions (weathering index > 100 day-inch/yr) (NUR EG-1557). | | Consist ent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2 ) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-27 | All Groups except Group 6: accessible and inaccessible interior/exterior concrete | Cracking due to expansion due to reaction with aggregates | Structures Monitoring Program. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 2 | 3.5.1-28 | Groups 1-3, 5-9: All | Cracks and distortion due to increased stress levels from settlement | Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 3 | 3.5.1-29 | Groups 1-3, 5-9: foundation | Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation | Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 4 | 3.5.1-30 | Group 4: Radial beam seats in BWR drywell; RPV support shoes for PWR with nozzle supports; Steam generator supports | Lock-up due to wear | ISI (IWF) or Structures Monitoring Program | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-31 | Groups 1-3, 5, 7-9: below-grade concrete components, such as exterior walls below grade and foundation | Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack; Cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel | Structures monitoring Program; Examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 2 | 3.5.1-32 | Groups 1-3, 5, 7-9: exterior above and below grade reinforced concrete foundations | Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide | Structures Monitoring Program for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 3 | 3.5.1-33 | Groups 1-5: concrete | Reduction of strength and modulus due to elevated temperature | A plant-specific aging management program is to be evaluated | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 4 | 3.5.1-34 | Group 6: Concrete; all | Increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack; cracking, loss of bond, loss of material due to corrosion of embedded steel | Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-35 | Group 6: exterior above and below grade concrete foundation | Loss of material (spalling, scaling) and cracking due to freeze-thaw | Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557). | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2 ) |
| 2 | 3.5.1-36 | Group 6: all accessible / inaccessible reinforced concrete | Cracking due to expansion/reaction with aggregates | Accessible areas: Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2 ) |
| 3 | 3.5.1-37 | Group 6: exterior above and below grade reinforced concrete foundation interior slab | Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide | For accessible areas, Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77. | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2 ) |
| 4 | 3.5.1-38 | Groups 7, 8: Tank liners | Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2 ) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-39 | Support members; welds; bolted connections; support anchorage to building structure | Loss of material due to general and pitting corrosion | Structures Monitoring Program | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 2 | 3.5.1-40 | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates | Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms | Structures Monitoring Program | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 3 | 3.5.1-41 | Vibration isolation elements | Reduction or loss of isolation function/radiation hardening, temperature humidity, sustained vibratory loading | Structures Monitoring Program | | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 4 | 3.5.1-42 | Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds | Cumulative fatigue damage (CLB fatigue analysis exists) | TLAA, evaluated in accordance with 10 CFR 54.21(c) | TLAA | Consistent with GALL, which recommends further evaluation (See SER Section 3.5.2.2.2) |
| 5 | 3.5.1-43 | Groups 1-3, 5, 6: all masonry block walls | Cracking due to restraint shrinkage, creep, and aggressive environment | Masonry Wall Program | | Consistent with GALL (See SER Section 3.5.2.1) |
| 6 | 3.5.1-44 | Group 6 elastomer seals, gaskets, and moisture barriers | Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants) | Structures Monitoring Program | | Consistent with GALL (See SER Section 3.5.2.1) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-45 | Group 6: exterior above and below grade concrete foundation; interior slab | Loss of material due to abrasion, cavitation | Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance | | Consistent with GALL (See SER Section 3.5.2.1) |
| 2 | 3.5.1-46 | Group 5: Fuel pool liners | Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion | Water Chemistry and monitoring of spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels. | | Consistent with GALL (See SER Section 3.5.2.1) |
| 3 | 3.5.1-47 | Group 6: all metal structural members | Loss of material due to general (steel only), pitting and crevice corrosion | Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance. If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included. | | Consistent with GALL (See SER Section 3.5.2.1) |
| 4 | 3.5.1-48 | Group 6: earthen water control structures - dams, embankments, reservoirs, channels, canals, and ponds | Loss of material, loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, Seepage | Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs | | Consistent with GALL (See SER Section 3.5.2.1) |
| 5 | 3.5.1-49 | Support members; welds; bolted connections; support anchorage to building structure | Loss of material/general, pitting, and crevice corrosion | Water Chemistry and ISI (IWF) | | Consistent with GALL (See SER Section 3.5.2.1) |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.5.1-50 | Groups B2, and B4: galvanized steel, aluminum, stainless steel support members; welds; bolted connections; support anchorage to building structure | Loss of material due to pitting and crevice corrosion | Structures Monitoring Program | | Consistent with GALL (See SER Section 3.5.2.1) |
| 2 | 3.5.1-51 | Group B1.1: high strength low-alloy bolts | Cracking due to stress corrosion cracking; loss of material due to general corrosion | Bolting Integrity | | Consistent with GALL (See SER Section 3.5.2.1) |
| 3 | 3.5.1-52 | Groups B2, and B4: sliding support bearings and sliding support surfaces | Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads | Structures Monitoring Program | | Consistent with GALL (See SER Section 3.5.2.1) |
| 4 | 3.5.1-53 | Groups B1.1, B1.2, and B1.3: support members: welds; bolted connections; support anchorage to building structure | Loss of material due to general and pitting corrosion | ISI (IWF) | | Consistent with GALL (See SER Section 3.5.2.1) |
| 5 | 3.5.1-54 | Groups B1.1, B1.2, and B1.3: Constant and variable load spring hangers; guides; stops | Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads | ISI (IWF) | | Consistent with GALL (See SER Section 3.5.2.1) |

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.5.1-56 | Groups B1.1, B1.2, and B1.3: Sliding surfaces | Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads | ISI (IWF) | | Consistent with GALL (See SER Section 3.5.2.1) |
| 3.5.1-57 | Groups B1.1, B1.2, and B1.3: Vibration isolation elements | Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading | ISI (IWF) | | Consistent with GALL (See SER Section 3.5.2.1) |
| 3.5.1-58 | Galvanized steel and aluminum support members; welds; bolted connections; support anchorage to building structure exposed to air - indoor uncontrolled | None | None | | Not Applicable |
| 3.5.1-59 | Stainless steel support members; welds; bolted connections; support anchorage to building structure | None | None | | Not Applicable |



### 3.5.2.1 AMR Results That Are Consistent with The GALL Report

Summary of Information in the Application

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 PNPS LRA is acceptable.

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In PNPS LRA Section 3.5.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the primary containment, reactor building, intake structure, process facilities, yard structures, and bulk commodities:

- Containment Leak Rate (B.1.9)
- Fire Protection (B.1.13.1)
- Containment In-Service Inspection CII-IWE (B.1.16.1)
- In-Service Inspection (ISI-IWF)(B.16.2)
- Periodic Surveillance and Preventive Maintenance (B.1.24)
- Structures Monitoring - Masonry Wall Program (B.1.29.1)
- Structures Monitoring (B.1.29.2)
- Water Control Structures Monitoring Program (B.1.29.3)
- Water Chemistry Control - BWR (B.1.32.2)

<u>Project Team Evaluation</u>

The project team reviewed its assigned PNPS LRA AMR 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, reactor building, intake structure, process facilities, yard structures, and bulk commodities components that are subject to an AMR.



[This section addresses consistency with the GALL Report. For each Tables 1 entry for which no further evaluation is required by the SRP-LR and the project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicant's basis for why it is acceptable. Identify documents reviewed, full title, revision, and/or date of issue, and the reviewer's basis for accepting the differences. If additional information is requested from the applicant to develop an acceptable reviewer finding, cite the applicant's docketed letter commitment or other docketed LRA supplement. The docketed item is to be cited by title, date and ADAMs accession number. Use Template 5 below for this purpose. There is to be a separate, numbered section for each aging effect in Table 1 that is to be discussed. Otherwise there is no need to discuss that particular Table 1 entry]

[This section also addresses Table 2 regarding consistency with the GALL Report when project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicants basis for why it is acceptable (for example, a different Note is used). This section also addresses Note E and why using an AMP that is different than that recommended in GALL Report is acceptable (see Example 13 at the end of this document)]

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**Template 5 - <u>Aging Management Reviews Results That Are Consistent With the GALL Report – With Identified Difference/Issue</u>**

3.[Y].2.1.S] Title of Aging Effect/Mechanism

In the discussion section of Table 3.Y.1, Item [NUMBER] of the PNPS LRA, the applicant stated that [provide description of in the LRA]. During the audit and review, the project team noted that [provide description of differences, the applicant's basis.]

[Identify documents reviewed and basis for acceptability, project team evaluation]

On the basis of its review, the project team found that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

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Conclusion

The project team has evaluated the applicant's claim of consistency with the GALL Report. The project team also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the project team found that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team found that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).



**3.5.2.2 AMR Results For Which Further Evaluation Is Recommended By The GALL Report**

Summary of Information in the Application

In PNPS LRA Section 3.5.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the aging effects related the primary containment, reactor building, intake structure, process facilities, yard structures, and bulk commodities components and component groups. The applicant also provided information concerning how it will manage the related aging effects.

Project Team Evaluation

For some AMR line-items assigned to the project team in the PNPS LRA Tables 3.5.1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNPS LRA Section 3.5.2.2 against the criteria provided in the SRP-LR Section 3.5.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 AMR line-item in Section 3.5 citing the item in Table 1.

3.5.2.2.1 PWR and BWR Containments

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas

The project team reviewed PNPS LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1.

SRP-LR Section 3.5.2.2.1.1 states that increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in inaccessible areas of PWR and BWR concrete and steel containments. The existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. However, the GALL Report recommends further evaluation of plant - specific programs to manage the aging effects for inaccessible areas if the environment is aggressive. Acceptance criteria are described in Branch Technical Position RLSB-1.

In the PNPS LRA Section 3.5.2.2.1.1, the applicant states that PNPS has a Mark I free-standing steel containment located within the reactor building. Inaccessible and accessible concrete areas are designed in accordance with American Concrete Institute (ACI) specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

- high cement content
- low water-to-cementratio
- proper curing
- adequate air entrainment



PNPS concrete also meets requirements of later ACI guide ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same American Society for Testing and Material (ASTM) standards for selection, application and testing of concrete. The below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Concrete was provided with air content between 3% and 6% and a water/cement ratio between 0.44 and 0.60. Therefore, increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not applicable for concrete in inaccessible areas. The absence of concrete aging effects is confirmed under the Structures Monitoring Program.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.1 for further evaluation. The project team found 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).

3.5.2.2.1.2 <u>Cracks and Distortion Due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking and Differential Settlement Due to Erosion of Porous Concrete Subfoundations, If Not Covered by Structures Monitoring Program</u>

The project team reviewed PNPS LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2.

SRP-LR Section 3.5.2.2.1.2 states cracks and distortion due to increased stress levels from settlement could occur in PWR and BWR concrete and steel containments. Also, reduction of foundation strength, cracking, and differential settlement of concrete elements due to erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. The existing program relies on structures monitoring program to manage these aging effects. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is within the scope of the applicant's structures monitoring program.

In the PNPS LRA Section 3.5.2.2.1.2, the applicant states that PNPS does not rely on a dewatering system for control of settlement. Structures are founded on dense to very dense silty sand and sand and gravel above the rock subgrade. PNPS containment was not identified in IN 97-11 as a plant susceptible to erosion of porous concrete subfoundations. Additionally, groundwater in-leakage is minimized by a waterproof membrane. This membrane protects the reactor building concrete against exposure to groundwater. Groundwater was not aggressive during plant construction and no changes in groundwater conditions have been observed at PNPS.



As a result, cracking and distortion due to increased stress level from settlement and reduction of foundation strength cracking and differential settlement due to erosion of porous concrete subfoundation are not applicable to PNPS concrete structures.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.2 for further evaluation. The project team found 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).

3.5.2.2.1.3 <u>Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature</u>

The project team reviewed PNPS LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3.

SRP-LR Section 3.5.2.2.1.3 states that a reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR concrete and steel containments. The implementation of 10 CFR 50.55a and ASME Section XI, Subsection IWL would not be able to identify the reduction of strength and modulus of concrete due to elevated temperature. Subsection CC-3400 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period. The GALL Report recommends further evaluation of a plant-specific aging management program if any portion of the concrete containment components exceeds specified temperature limits, i.e., general area temperature greater than 66°C (150°F) and local area temperature greater than 93°C (200°F). Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In the PNPS LRA Section 3.5.2.2.1.3, the applicant states that ASME Code, Section III, Division 2, Subsection CC indicates that aging due to elevated temperature exposure is not significant as long as concrete general area temperatures do not exceed 150°F and local area temperatures do not exceed 200°F. During normal operation, areas within primary containment are within these temperature limits. Therefore, reduction of strength and modulus of concrete structures due to elevated temperature is not an aging effect requiring management for PNPS containment concrete.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found 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 found 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).

3.5.2.2.1.4 Loss of Material Due to General, Pitting and Crevice Corrosion



The project team reviewed PNPS LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4.

SRP-LR Section 3.5.2.2.1.4 states that the loss of material due to general, pitting and crevice corrosion could occur in steel elements of accessible and inaccessible areas for all types of PWR and BWR containments. The existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if corrosion is significant. Acceptance criteria are described in Branch Technical Position RLSB-1.

In the PNPS LRA Section 3.5.2.2.1.4, the applicant states that PNPS containment is a Mark I steel containment located within the reactor building. PNPS reactor building concrete in contact with the drywell shell is designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete. The concrete meets requirements of later ACI guide ACI 201.2R-77 since both documents use the same ASTM standards for selection, application and testing of concrete. Concrete is monitored for cracks under the Structures Monitoring Program. The drywell steel shell and the moisture barrier where the drywell shell becomes embedded in the drywell concrete floor are inspected in accordance with the Containment Inservice Inspection (CII) (IWE) Program and Structures Monitoring Program.

The PNPS drywell concrete floor was chipped out at several locations to expose the drywell shell below floor level and no evidence of corrosion was found. UT examinations of the drywell shell indicated no significant wall reduction. To prevent corrosion of the lower part of the drywell shell, the interior and exterior surfaces are protected from contact with the atmosphere by complete concrete encasement. It is not credible for ground water to reach the drywell shell, assuming a crack in the concrete, since the concrete at this location is greater than 8 feet thick and poured in multiple horizontal planes. The sand cushion area is drained to protect the exterior surface of the drywell shell at the sand cushion interface from water that might enter the air gap. Therefore, significant corrosion of the drywell shell is not expected.

[Identify documents reviewed and basis for acceptability. project team evaluation]

The project team found 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 found 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).

3.5.2.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

The project team reviewed PNPS LRA Section 3.5.2.2.1.5 against the criteria in SRP-LR Section 3.5.2.2.1.5.

SRP-LR Section 3.5.2.2.1.5 states that the loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments 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 separately in Section 4.5, "Concrete Containment Tendon Prestress Analysis," of the SRP-LR.

In the PNPS LRA Section 3.5.2.2.1.5, the applicant states that PNPS is a Mark I containment and does not incorporate prestressed concrete in its design. Therefore, loss of prestress due to relaxation, shrinkage, creep, and elevated temperature is not an applicable aging effect.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.5 for further evaluation. The project team found 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).

3.5.2.2.1.6 Cumulative Fatigue Damage

In PNPS LRA Section 3.5.2.2.1.6, the applicant states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). The project team's evaluation of this TLAA is addressed separately in Section 4 of the SER related to the PNPS LRA.

3.5.2.2.1.7 Cracking Due to Stress Corrosion Cracking

The project team reviewed PNPS LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7.

SRP-LR Section 3.5.2.2.1.7 states that cracking due to stress corrosion cracking of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds could occur in all types of PWR and BWR containments. Cracking due to SCC could also occur in stainless steel vent line bellows for BWR containments. The existing program relies on ASME Section XI, Subsection IWE and10 CFR Part 50, Appendix J to manage this aging effect. The GALL Report recommends further evaluation of additional appropriate examinations/evaluations implemented to detect these aging effects for stainless steel penetration sleeves, penetration bellows and dissimilar metal welds, and stainless steel vent line bellows.

In the PNPS LRA Section 3.5.2.2.1.7, the applicant states that NUREG-1801 recommends further evaluation of inspection methods to detect cracking due to SCC since visual VT-3 examinations may be unable to detect this aging effect. Potentially susceptible components at PNPS are penetration sleeves and bellows.

Stress corrosion cracking becomes significant for stainless steel if tensile stresses and a corrosive environment exist. The stresses may be applied (external) or residual (internal). The normal environment inside the drywell is dry. The penetration components are not exposed to corrosive environments. Therefore, stress corrosion cracking is not an aging effect requiring management for the penetration sleeves and bellows, since the conditions necessary for SCC do not exist.



[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found 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 found 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).

3.5.2.2.1.8 <u>Cracking Due to Cyclic Loading</u>

The project team reviewed PNPS LRA Section 3.5.2.2.1.8 against the criteria in SRP-LR Section 3.5.2.2.1.8.

SRP-LR Section 3.5.2.2.1.8 states cracking due to cyclic loading of suppression pool steel and stainless steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) could occur for all types of PWR and BWR containments and BWR vent header, vent line bellows and downcomers. The existing program relies on ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J to manage this aging effect. However, VT-3 visual inspection may not detect fine cracks. The GALL Report recommends further evaluation for detection of this aging effect.

In the PNPS LRA Section 3.5.2.2.1.8, the applicant states that cyclic loading can lead to cracking of penetration sleeves, penetration bellows, and torus pool steel. If a CLB analysis does not exist, further evaluation is recommended of inspection methods to detect cracking due to cyclic loading since visual VT-3 examinations may be unable to detect this aging effect.

The analysis of cracking due to cyclic loading of the drywell, torus, and associated penetrations is a TLAA which is evaluated as documented in Section 4.6.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.8 for further evaluation. The project team found 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).

3.5.2.2.1.9 Loss of Material (Scaling, Cracking, and Spalling) Due to Freeze-Thaw

The project team reviewed PNPS LRA Section 3.5.2.2.1.9 against the criteria in SRP-LR Section 3.5.2.2.1.9.

SRP-LR Section 3.5.2.2.1.9 states that the loss of material (scaling, cracking, and spalling) due to freeze-thaw could occur in PWR and BWR concrete containments. The existing program relies on ASME Section XI, Subsection IWL to manage this aging effect. The GALL Report recommends further evaluation of this aging effect for plants located in moderate to severe weathering conditions.



In the PNPS LRA Section 3.5.2.2.1.9, the applicant states that PNPS has a Mark I free-standing steel containment located within the reactor building. Loss of material (scaling, cracking, and spalling) due to freeze-thaw is applicable only to concrete containments. Therefore, loss of material and cracking due to freeze-thaw do not apply.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.9 for further evaluation. The project team found 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).

3.5.2.2.1.10 Cracking Due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide

The project team reviewed PNPS LRA Section 3.5.2.2.1.10 against the criteria in SRP-LR Section 3.5.2.2.1.10.

SRP-LR Section 3.5.2.2.1.10 states that cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide could occur in concrete elements of PWR and BWR concrete and steel containments. The existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. The GALL Report recommends further evaluation if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

In the PNPS LRA Section 3.5.2.2.1.10, the applicant states that PNPS has a Mark I free-standing steel containment located within the reactor building. In accordance with NUREG-1801, aging management is not required because PNPS containment concrete (basemat) is designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete and concrete specification requires that the potential reactivity of aggregates be acceptable based on testing in accordance with ASTM C-289 and C-295.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.10 for further evaluation. The project team found 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 Safety-Related and Other Structures and Component Supports

3.5.2.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program



The project team reviewed PNPS LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

SRP-LR Section 3.5.2.2.2.1 states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1-5, 7, 9 structures; (2) increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, 9 structures; (3) loss of material due to corrosion for Groups 1-5, 7, 8 structures; (4) loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, 7-9 structures; (5) cracking due to expansion and reaction with aggregates for Groups 1-5, 7-9 structures; (6) cracks and distortion due to increased stress levels from settlement for Groups 1-3, 5-9 structures; and (7) reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation for Groups 1-3, 5-9 structures. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the structures monitoring program.

Lock up due to wear could occur for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the structures monitoring program or ASME Section XI, Subsection IWF to manage this aging effect. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ISI (IWF) or structures monitoring program.

In the PNPS LRA Section 3.5.2.2.2.1, the applicant addressed various aging effects not covered by the structures monitoring program of concrete and steel elements due to various aging mechanisms. The PNPS LRA stated that PNPS concrete structures subject to aging management review are included in the Structures Monitoring Program. This is true for concrete items even if the aging management review did not identify aging effects requiring management. Aging effects discussed below for structural steel items are also addressed by the Structures Monitoring Program. Additional discussion of specific aging effects follows.

1. Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-5, 7, 9 Structures.

   The aging mechanisms associated with cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are applicable only to below-grade concrete/grout structures. The below-grade environment for PNPS is not aggressive and concrete is designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions by providing a high cement, low water/cement ratio (between 0.44 and 0.60), proper curing and adequate air content between 3 percent and 6 percent. Therefore, cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not aging effects requiring management for PNPS Groups 1-5, 7, 9 structures.



2. Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) due to Aggressive Chemical Attack for Groups 1-5, 7, 9 Structures.

   Aggressive chemical attack becomes significant to concrete exposed to an aggressive environment. Resistance to mild acid attack is enhanced by using a dense concrete with low permeability and low water-to-cement ratio of less than 0.50. These groups of structures at PNPS use a dense low permeable concrete with a maximum water-to-cement ratio of 0.48, which provides an acceptable degree of protection against aggressive chemical attack. Water chemical analysis results confirm that the site groundwater is considered to be non-aggressive. PNPS concrete is constructed in accordance with the recommendations in ACI 201.2R-77 for durability.

   PNPS below-grade environment is not aggressive. Therefore, increase in porosity and permeability cracking, loss of material (spalling, scaling) due to aggressive chemical attack are not aging effects requiring management for PNPS Groups 1-5, 7, 9 concrete structures.

3. Loss of Material Due to Corrosion for Groups 1-5, 7, 8 Structures

   PNPS Structures Monitoring Program will be used to manage aging effect requiring management for PNPS Groups 1-5, 7, 8 structures.

4. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, 7-9 Structures

Aggregates were in accordance with specifications and materials conforming to ACI and ASTM standards. PNPS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios are within the limits provided in ACI 318, and air entrainment percentages were within the range prescribed in NUREG-1801. Therefore, loss of material (spalling, scaling) and cracking due to freeze thaw are not aging effects requiring management for PNPS Groups 1-3, 5, 7-9 structures.

5. Cracking Due to Expansion and Reaction with Aggregates for Groups 1-5, 7-9 Structures

Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction, which are in accordance with the recommendations in ACI 201.2R-77 for concrete durability. PNPS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios are within the limits provided in ACI 318-63, and air entrainment percentages were within the range prescribed in NUREG-1801. Therefore, cracking due to expansion and reaction with aggregates for Groups 1-3, 5, 7-9 structures is not an aging effect requiring management for PNPS concrete.

6. Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3, 5-9 Structures



Groups 1-3, 5-9 structures at PNPS are founded on dense to very dense silty sand and sand and gravel. No significant settlement has occurred since construction and additional settlement is not anticipated. Therefore, cracks and distortion due to increased stress levels from settlement for Groups 1-3, structures is not an aging mechanism for PNPS concrete.

7. Reduction in Foundation Strength, Cracking, Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1-3, 5-9 Structures

PNPS structures are not constructed of porous concrete. Concrete was provided in accordance with ACI 318-63 requirements resulting in dense, well-cured, high strength concrete with low-permeability. Therefore, reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation are not aging effects requiring management for PNPS Groups 1-3, 5-9 structures.

8. Lock Up Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

Owing to the wear-resistant material used, the low frequency (number of times) of movement, and the slow movement between sliding surfaces, lock-up due to wear is not an aging effect requiring management at PNPS. However, Lubrite® plates are included within the Structures Monitoring Program and Inservice Inspection (ISI-IWF) Programs to confirm the absence of aging effects requiring management for this component.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found 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 found 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).

3.5.2.2.2.2 Aging Management of Inaccessible Areas

The project team reviewed PNPS LRA Section 3.5.2.2.2.2 against the criteria in SRP-LR Sections 3.5.2.2.2.2.1 through 3.5.2.2.2.2.5. In Section 3.5.2.2.2.2 of the PNPS LRA the applicant responded to five separate areas of concern identified in the SRP-LR with a single response. The five areas of concern from the SRP-LR are provided below, followed by the applicant's response.

3.5.2.2.2.2.1 Aging Management of Inaccessible Areas [Item 1]

SRP-LR Section 3.5.2.2.2.2.1 states that the loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures for plants located in moderate to severe weathering conditions.



3.5.2.2.2.2.2 Aging Management of Inaccessible Areas [Item 2]

SRP-LR Section 3.5.2.2.2.2.2 states that cracking due to expansion and reaction with aggregates could occur in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures. The GALL Report recommends further evaluation of inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

3.5.2.2.2.2.3 Aging Management of Inaccessible Areas [Item 3]

SRP-LR Section 3.5.2.2.2.2.3 states that cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The existing program relies on structures monitoring program to manage these aging effects. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

3.5.2.2.2.2.4 Aging Management of Inaccessible Areas [Item 4]

SRP-LR Section 3.5.2.2.2.2.4 states that an increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas of these Groups of structures if the environment is aggressive. The acceptance criteria are described in Branch Technical Position RLSB-1.

3.5.2.2.2.2.5 Aging Management of Inaccessible Areas [Item 5]

SRP-LR Section 3.5.2.2.2.2.5 states that increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

3.5.2.2.2.2 PNPS Response to 3.2.2.2.2.1 through 3.2.2.2.2.5

In the PNPS LRA Section 3.5.2.2.2.2, the applicant states that PNPS concrete for Group 1-3, 5 and 7-9 inaccessible concrete areas was provided in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which requires the following, resulting in low permeability and resistance to aggressive chemical solution.

- high cement content,
- low water permeability,
- proper curing, and
- adequate air entrainment.

PNPS concrete also meets requirements of later ACI guide ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same ASTM standards for selection, application and testing of concrete.

Inspections of accessible concrete have not revealed degradation related to corrosion of embedded steel. PNPS below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, corrosion of embedded steel is not an aging effect requiring management for PNPS concrete.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.1 through 3.5.2.2.2.2.5 for further evaluation. The project team found 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).

3.5.2.2.2.3 Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature

The project team reviewed PNPS LRA Section 3.5.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.3.

SRP-LR Section 3.5.2.2.2.3 states that a reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR Group 1-5 concrete structures. For any concrete elements that exceed specified temperature limits, further evaluations are recommended. Appendix A of ACI 349-85 specifies the concrete temperature limits for normal operation or any other long-term period. The temperatures shall not exceed 150°F except for local areas, which are allowed to have increased temperatures not to exceed 200°F. The GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits, i.e., general area temperature greater than 66°C (150°F) and local area temperature greater than 93°C (200°F). The acceptance criteria are described in Branch Technical Position RLSB-1.

In the PNPS LRA Section 3.5.2.2.2.3, the applicant stated that group 1-5 concrete elements do not exceed the temperature limits associated with aging degradation due to elevated temperature. Therefore, reduction of strength and modulus of concrete due to elevated temperatures is not an aging effect requiring management for PNPS.



[Identify documents reviewed and basis for acceptability. project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.3 for further evaluation. The project team found 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).

3.5.2.2.2.4 Aging Management of Inaccessible Areas for Group 6 Structures

The project team reviewed PNPS LRA Section 3.5.2.2.2.4 against the criteria in SRP-LR Section 3.5.2.2.2.4.

SRP-LR Section 3.5.2.2.2.4 states that the GALL Report recommends further evaluation for inaccessible areas of certain Group 6 structure/aging effect combinations as identified below, whether or not they are covered by inspections in accordance with the GALL Report, Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC / US Army Corp of Engineers dam inspections and maintenance.

1. Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas if the

environment is aggressive. The acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

2. Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas for plants located in moderate to severe weathering conditions.

3. Cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible reinforced concrete areas of Group 6 structures. The GALL Report recommends further evaluation of inaccessible areas if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

In the PNPS LRA Section 3.5.2.2.2.4.1, the applicant states that for inaccessible areas of certain Group 6 structures, aging effects are covered by inspections in accordance with the Structures Monitoring Program.

1. Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack; and Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel in Below-Grade Inaccessible Concrete Areas of Group 6 Structures.

   Below-grade exterior reinforced concrete at PNPS is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate). Therefore, increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel are not an aging effect requiring management for below-grade inaccessible concrete areas of PNPS Group 6 structures.

2. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-thaw in Below- Grade Inaccessible Concrete Areas of Group 6 Structures.

   Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction. PNPS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios are within the limits provided in ACI 318, and air entrainment percentages were within the range prescribed in NUREG-1801. Therefore, loss of material (spalling, scaling) and cracking due to freeze thaw is not aging effects requiring management for PNPS Groups 6 structures below-grade and not continuously exposed to raw water.

   For Group 6 concrete that is continuously exposed to raw water of the Cape Cod Bay that may become saturated, it is conservatively considered susceptible to freeze-thaw and managed by the Structures Monitoring Program.

3. Cracking Due to Stress Corrosion Cracking, Reaction with Aggregates, Increase in Porosity and Permeability, and Loss of Strength Due to Leaching of Calcium Hydroxide in Below-Grade Inaccessible Concrete Areas of Group 6 Structures.

Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction, which are in accordance with the recommendations in ACI 201.2R-77 for concrete durability. PNPS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios are within the limits provided in ACI 318-63, and air entrainment percentages were within the range prescribed in NUREG-1801. PNPS below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm).

Therefore, cracking due to expansion and reaction with aggregates, increase in porosity and permeability due to leaching of calcium hydroxide in below grade inaccessible concrete areas of Group 6 Structures is not an aging mechanism for PNPS concrete.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4 for further evaluation. The project team found 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).



3.5.2.2.2.5 <u>Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion</u>

The project team reviewed PNPS LRA Section 3.5.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.5.

SRP-LR Section 3.5.2.2.2.5 states that cracking due to stress corrosion cracking and loss of material due to pitting and crevice corrosion could occur for Group 7 and 8 stainless steel tank liners exposed to standing water. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects. The acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In the PNPS LRA Section 3.5.2.2.2.5, the applicant states that no tanks with stainless steel liners are included in the structural aging management reviews. Tanks subject to aging management review are evaluated with their respective mechanical systems.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.5 for further evaluation. The project team found 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).

3.5.2.2.2.6 Aging of Supports Not Covered by Structures Monitoring Program

The project team reviewed PNPS LRA Section 3.5.2.2.2.6 against the criteria in SRP-LR Section 3.5.2.2.2.6.

SRP-LR Section 3.5.2.2.2.6 states that the GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) loss of material due to general and pitting corrosion, for Groups B2-B5 supports; (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

In the PNPS LRA Section 3.5.2.2.2.6, the applicant states that NUREG-1801 recommends further evaluation of certain component support/aging effect combinations if they are not covered by the applicant's Structure Monitoring Program. Component supports at PNPS are included in the Structures Monitoring Program for Groups B2 through B5 and Inservice Inspection (ISI-IWF) Program for Group B1.

1. Reduction in concrete anchor capacity due to degradation of the surrounding concrete for Groups B1 through B5 supports PNPS concrete anchors and surrounding concrete are included in the Structures Monitoring Program (Groups B2 through B5) and Inservice Inspection (ISI-IWF) Program (Group B1).

2. Loss of material due to general and pitting corrosion, for Groups B2 through B5 supports

   Loss of material due to corrosion of steel support components is an aging effect requiring management at PNPS. This aging effect is managed by the Structures Monitoring Program.

3. Reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports

The PNPS aging management review did not identify any component support structure/aging effect combination corresponding to NUREG-1801 Volume 2 Item III.B4.2-a.

[Identify documents reviewed and basis for acceptability. project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.6 for further evaluation. The project team found 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).

3.5.2.2.2.7 Cumulative Fatigue Damage Due to Cyclic Loading

In LRA Section 3.5.2.2.2.7, the applicant states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). The project team's evaluation of this TLAA is addressed separately in Section 4 of the SER related to the PNPS LRA.

3.5.2.2.3 Quality Assurance for Aging Managementof Nonsafety-Related Components

PNPS LRA Section 3.5.2.2.3 is reviewed by NRR DE staff and will be addressed separately in Section 3 of the SER related to the PNPS LRA.

In PNPS LRA Section 3.5.2.2.3 states that Appendix B, Section B.0.3 contains a discussion of the PNPS quality assurance procedures and administrative controls for the aging management program.

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 determined that the applicant adequately addressed the issues that were further evaluated. The project team found 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).



### 3.5.2.3 AMR Results That Are Not Consistent With The GALL Report Or Not Addressed In The GALL Report

Summary of Information in the Application

In PNPS LRA Table 3.5.1, Summary of Aging Management Evaluations for the Primary Containment, Structures, Component Supports, and Piping and Component Insulation, the applicant provided information regarding components or material/environment combination in the GALL Report that it evaluated and identified as not applicable to its plant.

In PNPS LRA Tables 3.5.2-1 through 3.5.2-6, the applicant provided additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report. Specifically, the applicant indicated, via Notes F through J, that neither the identified component nor the material/environment combination is evaluated in the GALL Report and provided information concerning how the aging effect requiring management will be managed.

Project Team Evaluation

The project team reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

Aging Effect/Mechanism in Table 3.5.1 That Are Not Applicable for PNPS

[This section is for write-up of the AMR line-items that the applicant claims are not used or not applicable to its plant in LRA Table 1. The write-up does not include the "further evaluation required" in Table 1 since they are evaluated in Section 3.[Y].2. In addition, the evaluation is not necessary if the plant is of a different vintage (PWR vs. BWR)]]

The project team reviewed PNPS LRA Table 3.5.1, which provides a summary of aging management evaluations for the primary containment, structures, component supports, and piping and component insulation evaluated in the GALL Report.

In PNPS LRA Table 3.5.1 Item 3.5.1-1 discussion column the applicant states that the aging of accessible and inaccessible concrete areas due to aggressive chemical attack and corrosion of embedded steel of concrete elements including walls, domes, basemat, ring girder, buttresses, and containment is not applicable to NPPS because the listed concrete elements apply to PWR containments and and concrete BWR containments. The PNPS containment is a Mark I steel containment.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.5.1, Item 3.5.1-2 discussion column the applicant states that cracks and distortion due to increased stress levels from settlement of all concrete elements is not applicable to PNPS because NUREG-1801 Volume 2 items referencing this aging effect are associated with concrete containment. The PNPS containment is a Mark I steel containment. Concrete elements are limited to floor slab and reactor vessel pedestal. These elements are not subject to the listed aging management effect because they are founded on the reactor building base slab.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1, Item 3.5.1-3 discussion column the applicant states that the reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation is not applicable to PNPS because NUREG-1801, Volume 2 items referencing this item are associated with concrete containments. The PNPS containment is a Mark I steel containment.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-4 discussion column the applicant states that the reduction of strength and modulus due to elevated temperature of concrete elements including dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus is not applicable to PNPS because NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. PNPS has a Mark I steel containment.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-6 discussion column the applicant states that the loss of material due to general and crevice corrosion of steel elements including steel liner, liner anchors, and integral attachments is not applicable to PNPS because NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. PNPS has a Mark I steel containment.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-7 discussion column the applicant states that the loss of prestress due to relaxation, shrinkage, creep, and elevated temperature of prestressed containment tendons is not applicable to PNPS because NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. PNPS has a Mark I steel containment.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA table 3.5.1 Item 3.5.1-9 discussion column the applicant states that cumulative fatigue damage of steel, stainless steel elements, dissimilar metal welds, penetration sleeves, penetration bellows, suppression pool shell, and unbraced downcomers is not applicable to PNPS because cumulative fatigue damage is a TLAA which is evaluated in accordance with 10 CFR 54.21(c). Fatigue TLAAs for the steel drywell, torus, and associated penetrations are evaluated separately as described in Section 4.6 of the PNPS LRA.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1, Item 3.5.1-10discussion column the applicant states that stress corrosion cracking (SSC) of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds is not applicable to PNPS because SSC becomes significant for stainless steel if tensile stresses and a corrosive environment exist. The normal environment inside the drywell is dry. The penetration components are not exposed to a corrosive environment. Therefore, SCC is not an aging effect requiring management for penetration sleeves and bellows, since the conditions necessary for SSC do not exist at PNPS.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-11 discussion column the applicant states that stress corrosion cracking (SSC) of stainless steel vent line bellows is not applicable to PNPS because SSC becomes significant for stainless steel if tensile stresses and a corrosive environment exist. The normal environment inside the drywell is dry. The penetration components are not exposed to a corrosive environment. Therefore, SCC is not an aging effect requiring management for penetration sleeves and bellows, since the conditions necessary for SSC do not exist at PNPS.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-14discussion column tha applicant states that the loss of material (scaling, cracking, and spalling) due to freeze-thaw of concrete elements including dome, wall, basemat, ring girder, buttress, and containment is not applicable to PNPS because NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. PNPS has a Mark I steel containment.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-15 discussion column the applicant states that cracking due to expansion and reaction with aggregate; increase in porosity, and permeability due to leaching of calcium hydroxide of concrete elements such as walls, dome, basemat, ring girder, buttresses, containment, and concrete fill-in annulus is not applicable to PNPS because NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. PNPS has a Mark I steel containment.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-19 discussion column the applicant states that the cracking due to stress corrosion cracking of steel elements including stainless steel suppression chamber shell liner surface is not applicable to PNPS because the aging effect is applicable to stainless steel suppression chambers whereas the PNPS suppression chamber is carbon steel.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-20 discussion column the applicant states that the loss of material due to general, pitting, and crevice corrosion of steel elements including the interior surface of the suppression chamber liner is not applicable to PNPS because NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. PNPS has a Mark I steel containment.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.5.1 Item 3.5.1-22 discussion column the applicant states that the loss of material due to corrosion of prestressed containment tendons and anchorage components is not applicable to PNPS because the PNPS containment is a Mark 1 steel containment structure with no prestressed tendons.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.5.1 Item 3.5.1-42 discussion column the applicant states that the cumulative fatigue damage (assuming a CLB fatigue analysis exists) for Groups B1.1 (Class 1 supports for ASME piping components), B1.2 (Class 2 and 3 supports for ASME piping components), and B1.3 (Class MC [BWR Containment Supports] supports for ASME piping components) does not apply to PNPS because no CLB fatigue analysis exists.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the primary containment, structures, component supports, and piping and component insulation at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

[Repeat the above three paragraphs, if applicable, for all items that the applicant claims is not applicable to its plant]

[If there are RAIs or issues that affect all Tables, provide discussion and evaluation here]

[If the LRA lists a series of components which have no aging effect and therefore do not require aging management, the following writeup may be used, as appropriate.]

<u>Primary Containment, Structures, Component Supports, and Piping and Component Insulation AMR Line Items That Have No Aging Effect (PNPS LRA Tables 3.5.2-1 through 3.5.2-6)</u>



In PNPS LRA Tables 3.5.2-1 through 3.5.2-6, the applicant identified AMR line-items where no aging effects requiring management were identified as a result of its aging review process. Specifically, instances in which the applicant states that no aging effects requiring management were identified occur for the following conditions:

- primary containment electrical penetration seals and sealant components fabricated alumina-ceramic with bonding resin subject to a "protected from weather" environment. The material is not in NUREG-1801 for this component.

On the basis of its review of current industry research and operating experience, the project team found that [environments] on [materials] will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for [materials] components exposed to [list of environment] environments.

- metal siding components fabricated from aluminum exposed to an "outdoor weather" environment. The material is not in NUREG-1801 for this component.

On the basis of its review of current industry research and operating experience, the project team found that [environments] on [materials] will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for [materials] components exposed to [list of environment] environments.

- Insulation fabricated from fiberglass and calcium silicate exposed to a "protected from the weather" environment. Neither the component nor the material and environment combination in evaluated in NUREG-1801. The loss of insulating characteristics due to insulation degradation is not an aging effect requiring management for insulation material. Insulation products, which are made from fiberglass fiber, calcium silicate, stainless steel, and similar materials, that are protected from weather do not experience aging effects that would significantly degrade their ability to insulate as designed. A review of site operating experience identified no aging effects for insulation used at PNPS.

On the basis of its review of current industry research and operating experience, the project team found that [environments] on [materials] will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for [materials] components exposed to [list of environment] environments.

- water stops fabricated from PVC are exposed to the weather. Neither the component nor the material and environment combination are evaluated in NUREG-1801.

On the basis of its review of current industry research and operating experience, the project team found that [environments] on [materials] will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for [materials] components exposed to [list of environment] environments.



3.5.2.3.1 Primary Containment - Summary of Aging Management Evaluation - PNPS LRA Table 3.5.2-1

The project team reviewed the PNPS LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the primary containment component groups.

In LRA Table 3.5.2-1, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], "[Name of PNPS AMP]."

The project team reviewed [Name of PNPS AMP] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.5.2.3.2 Reactor Containment - Summary of Aging Management Evaluation - PNPS LRA Table 3.5.2-2

The project team reviewed the PNPS LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the reactor containment component groups.

In LRA Table 3.5.2-2, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], "[Name of PNPS AMP]."

The project team reviewed [Name of PNPS AMP] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.5.2.3.3 <u>Intake Structure - Summary of Aging Management Evaluation - PNPS LRA Table 3.5.2-3</u>

The project team reviewed the PNPS LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the intake structure component groups.

In LRA Table 3.5.2-3, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], "[Name of PNPS AMP]."

The project team reviewed [Name of PNPS AMP] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.5.2.3.4 <u>Process Facility - Summary of Aging Management Evaluation - PNPS LRA Table 3.5.2-4</u>

The project team reviewed the PNPS LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the process facility component groups.

In LRA Table 3.5.2-4, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], "[Name of PNPS AMP]."

The project team reviewed [Name of PNPS AMP] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.5.2.3.5 Yard Structures - Summary of Aging Management Evaluation - PNPS LRA Table 3.5.2-5

The project team reviewed the PNPS LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the yard structures component groups.

In LRA Table 3.5.2-5, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], "[Name of PNPS AMP]."

The project team reviewed [Name of PNPS AMP] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

3.5.2.3.6 Bulk Commodities - Summary of Aging Management Evaluation - PNPS LRA Table 3.5.2-6

The project team reviewed the PNPS LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the bulk commodities component groups.

In LRA Table 3.5.2-6, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], "[Name of PNPS AMP]."

The project team reviewed [Name of PNPS AMP] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

On the basis of its audit and review of the applicant's program, the project team found 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, the project team found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not addressed in the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.5.3 Conclusion

On the basis of its review, the project team concluded that the applicant has demonstrated that the aging effects associated with the primary containment, structures, component supports, and piping and component insulation components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable UFSAR supplement program summaries and primary containment, structures, component supports, and piping and component insulation components, as required by 10 CFR 54.21(d).

## 3.6 Aging Management of Electrical Components

This section of the audit and review report document the project team's review and evaluation of PNPS aging management review (AMR) results for the aging management of the electrical component and component groups associated with the following systems:

- high voltage insulators
- insulated cables and connectors
- phase bus
- switchyard bus



### 3.6.1 Summary of Technical Information in the Application

In the PNPS LRA Section 3.6, the applicant provided the results of its AMRs for the electrical components and component groups.

In PNPS LRA Table 3.6.1, "Summary of Aging Management Evaluations for the Electrical Components and I&C Components Evaluated in Chapter VI of NUREG-1801," the applicant provided a summary comparison of its AMR line-items with the AMR line-items evaluated in the GALL Report for the electrical components and component groups. The applicant also identified for each component type in the PNPS LRA Table 3.6.1 those components that are consistent with the GALL Report, those for 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.

In the PNPS LRA Table 3.6.2-1 the applicant provided a summary of the AMR results for component types associated with (1) high voltage insulators, (2) insulated cables and connectors, (3) phase bus, and (4) switchyard bus. Specifically, the 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 PNPS LRA Table 3.6.1 (Table 1), and generic and plant-specific notes related to consistency with the GALL Report.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effect requiring managements (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

### 3.6.2 Project Team Evaluation

The project team reviewed PNPS LRA Section 3.6 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the electrical components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team reviewed certain identified AMR line-items to confirm the applicant's claim that these AMR line-items were consistent with the GALL Report. The project team did not repeat its review of the matters described in the GALL Report. However, the project team did verify that the material presented in the PNPS LRA was applicable and that the applicant had identified the appropriate GALL Report AMR line-items. The project team's audit evaluation is documented in Section 3.6.2.1 of this audit and review report. In addition, the project team's evaluations of the AMPs are documented in Section 3.0.3 of this audit and review report.

The project team reviewed those selected AMR line-items for which further evaluation is recommended by the GALL Report. The project team confirmed that the applicant's further evaluations were in accordance with the acceptance criteria in SRP-LR. The project team's audit evaluation is documented in Section 3.6.2.2 of this audit and review report.

The project team also reviewed of the remaining AMR line-items that were not consistent with or not addressed in the GALL Report based on NRC-approved precedents. The audit included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The project team's evaluation is documented in Section 3.6.2.3 of this audit and review report.

Finally, the project team reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the electrical components.

Table 3.6-1 below provides a summary of the project team's evaluation of components, aging effects/aging mechanisms, and AMPs listed in LRA Section 3.6 that are addressed in the GALL Report. It also includes the section of the audit and review report in which the project team's evaluation is documented.

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**Table 3.6-1 Staff Evaluation for Electrical Components in the GALL Report**

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.6.1-1 | Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements | Degradation due to various aging mechanisms | Environmental Qualification of Electric Components | | |
| 3.6.1-2 | Electrical cables, connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements | Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms | Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements | | |
| 3.6.1-3 | Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (IR) | Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms | Electrical Cables And Connections Used In Instrumentation Circuits Not Subject To 10 CFR 50.49 EQ Requirements | | |
| 3.6.1-4 | Conductor insulation for inaccessible medium voltage (2 kV to 35 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements | Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water trees | Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements | | |
| 3.6.1-5 | PWR Only | | | | |
| 3.6.1-6 | Fuse Holders (Not Part of a Larger Assembly): Fuse holders - metallic clamp | Fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation | Fuse Holders | | |

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| | Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|---|
| 1 | 3.6.1-7 | Metal enclosed bus - Bus/connection | Loosening of bolted connections due to thermal cycling and ohmic heating | Metal Enclosed Bus | | |
| 2 | 3.6.1-8 | Metal enclosed bus - Insulation/ insulators | Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms | Metal Enclosed Bus | | |
| 3 | 3.6.1-9 | Metal enclosed bus - Enclosure assemblies | Loss of material due to general corrosion | Structures Monitoring Program | | |
| 4 | 3.6.1-10 | Metal enclosed bus - Enclosure assemblies | Hardening and loss of strength due to elastomers degradation | Structures Monitoring Program | | |
| 5 | 3.6.1-11 | High voltage insulators | Degradation of insulation quality due to presence of any salt deposits and surface contamination; Loss of material caused by mechanical wear due to wind blowing on transmission conductors | A plant-specific aging management program is to be evaluated | | |
| 6 | 3.6.1-12 | Transmission conductors and connections; switchyard bus and connections | Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload | A plant-specific aging management program is to be evaluated | | |

| Item No. | Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Staff Evaluation |
|---|---|---|---|---|---|
| 3.6.1-13 | Cable Connections - Metallic parts | Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation | Electrical Cable Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements | | |
| 3.6.1-14 | Fuse Holders (Not Part of a Larger Assembly) Insulation material | None | None | | |

### 3.6.2.1 AMR Results That Are Consistent with The GALL Report

Summary of Information in the Application

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 PNPS LRA is acceptable.

In PNPS LRA Section 3.6.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the (1) high voltage insulators, (2) insulated cables and connectors, (3) phase bus, and (4) switchyard bus:

- Metal-Enclosed Bus Inspection Program (B.1.18)
- Non-EQ Inaccessible Medium-Voltage Cable Program (B.1.19)
- Non-EQ Instrumentation Circuits Test Review Program (B.1.20)
- Non-EQ Insulated Cables and Connections Program (B.1.21)

Project Team Evaluation

The project team reviewed its assigned PNPS LRA AMR 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 (1) high voltage insulators, (2) insulated cables and connectors, (3) phase bus, and (4) switchyard bus components that are subject to an AMR.

This section addresses consistency with the GALL Report. For each Tables 1 entry for which no further evaluation is required by the SRP-LR and the project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicant's basis for why it is acceptable. Identify documents reviewed, full title, revision, and/or date of issue, and the reviewer's basis for accepting the differences. If additional information is requested from the applicant to develop an acceptable reviewer finding, cite the applicant's docketed letter, commitment or other docketed LRA supplement. The docketed item is to be cited by title, date and ADAMs accession number. Use Template 5 below for this purpose. There is to be a separate, numbered section for each aging effect in Table 1 that is to be discussed. Otherwise, there is no need to discuss that particular Table 1 entry]

[This section also addresses Table 2 regarding consistency with the GALL Report when project team identified differences not identified by the applicant in the LRA or if there is a technical or documentation issue uncovered during the audit and review, describe the difference or issue and the applicants basis for why it is acceptable (for example, a different Note is used). This section also addresses Note E and why using an AMP that is different than that recommended in GALL Report is acceptable (see Example 13 at the end of this document)]

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Template 5 - Aging Management Reviews Results That Are Consistent With the GALL Report – With Identified Difference/Issue

3.[Y].2.1.S] Title of Aging Effect/Mechanism

In the discussion section of Table 3.Y.1, Item [NUMBER] of the PNPS LRA, the applicant stated that [provide description of in the LRA]. During the audit and review, the project team noted that [provide description of differences, the applicant's basis.]

[Identify documents reviewed and basis for acceptability, project team evaluation]

On the basis of its review, the project team found that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

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Conclusion

The project team has evaluated the applicant's claim of consistency with the GALL Report. The project team also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the project team found that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team found that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.6.2.2 AMR Results For Which Further Evaluation Is Recommended By The GALL Report

Summary of Information in the Application

In PNPS LRA Section 3.6.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the insulated cables and connections, electrical penetrations, high-voltage insulators, transmission conductors & connections, fuse holders, wooden utility poles, cable connections (metallic parts), and uninsulated ground conductors components and component groups. The applicant also provided information concerning how it will manage the related aging effects.

<u>Project Team Evaluation</u>

For some AMR line-items assigned to the project team in the PNPS LRA Tables 3.6.1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNPS 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 AMR line-item in Section 3.6 citing the item in Table 1.

3.6.2.2.1 <u>Electrical Equipment Subject to Environmental Qualification</u>

The project team reviewed PNPS LRA Section 3.6.2.2.1 against the criteria in SRP-LR Section 3.6.2.2.1.

SRP-LR Section 3.6.2.2.1 states that 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 TLAA is addressed separately in Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment" of this SRP-LR.



In the PNPS LRA Section 3.6.2.2.1, the applicant states that environmental qualification analyses are TLAAs as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of TLAAs is addressed in Section 4.4 of this application.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.6.2.2.1 for further evaluation. The project team found 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).

3.6.2.2.2 <u>Degradation of Insulator Quality Due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material Due to Mechanical Wear</u>

The project team reviewed PNPS LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2.

SRP-LR Section 3.6.2.2.2 states that the degradation of insulator quality due to presence of any salt deposits and surface contamination could occur in high voltage insulators. The GALL Report recommends further evaluation of a plant-specific aging management program for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind blowing on transmission conductors could occur in high voltage insulators. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.6.2.2.2, the applicant states that high voltage insulators supporting conductors that provide recovery of offsite power following SBO include those associated with the switchyard bus located between switchyard breakers 352-2 / 352-3 and startup transformer X4. High voltage insulators associated with this path are subject to aging management review.

Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination in most areas is washed away by rain. The glazed and coated insulator surface aids this contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. PNPS is located near the seacoast where salt spray is considered. However, salt spray buildup is a short-term concern based on local weather conditions (event-driven). Under conducive weather conditions, salt buildup occurs in a matter of hours or days. Therefore, surface contamination is not an applicable aging mechanism for high-voltage insulators at PNPS.

Mechanical wear is an aging effect for strain and suspension insulators in that they are subject to movement. Wear has not been apparent during routine inspections. If left unmanaged for the period of extended operation surface rust would not cause a loss of intended function and thus, is not a significant concern. Loss of material due to wear will not cause a loss of intended function of the insulators. Therefore, loss of material is not an aging effect requiring management for insulators.

There are no aging effects requiring management for high-voltage insulators.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.6.2.2.2 for further evaluation. The project team found 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).

3.6.2.2.3 <u>Loss of Material Due to Wind Induced Abrasion and Fatigue, Loss of Conductor Strength Due to Corrosion, an Increased Resistance of Connection Due to Oxidation or Loss of Pre-Load</u>

The project team reviewed PNPS LRA Section 3.6.2.2.3 against the criteria in SRP-LR Section 3.6.2.2.3.

SRP-LR Section 3.6.2.2.3 states that a loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load could occur in transmission conductors and connections, and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.6.2.2.3, the applicant states that transmission conductors are uninsulated, stranded electrical cables used outside buildings in high voltage applications. The transmission conductor commodity group includes the associated fastening hardware, but excludes the high-voltage insulators. Major active equipment assemblies include their associated transmission conductor terminations.

Transmission conductors are subject to aging management review if they are necessary for recovery of offsite power following an SBO. However, PNPS does not utilize transmission conductors in the circuits for recovery of offsite power following an SBO. Other transmission conductors are not subject to aging management review since they do not perform a license renewal intended function.

Switchyard bus is uninsulated, un-enclosed, rigid electrical conductors used in medium and high voltage applications. Switchyard bus includes the hardware used to secure the bus to high-voltage insulators. Switchyard bus establishes electrical connections to disconnect switches, switchyard breakers, and transformers to support recovery of offsite power following SBO.



Connection surface oxidation for aluminum switchyard bus is not applicable since switchyard bus connections requiring AMR are welded connections. For ambient environmental conditions at PNPS, no aging effects have been identified that could cause a loss of intended function for the period of extended operation. Vibration is not applicable since flexible connectors connect switchyard bus. Therefore, there are no aging effects requiring management for aluminum switchyard bus.

[Identify documents reviewed and basis for acceptability, project team evaluation]

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.6.2.2.3 for further evaluation. The project team found 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).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

PNPS LRA Section 3.6.2.2.4 is reviewed by NRR DE staff and will be addressed separately in Section 3 of the SER related to the PNPS LRA.

In PNPS LRA Section 3.6.2.2.4 the applicant states that a discussion of PNPS quality assurance procedures and administrative controls for the aging management programs are contained in Appendix B Section B.0.3 of the PNPS LRA.

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 determined that the applicant adequately addressed the issues that were further evaluated. The project team found 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).

### 3.6.2.3 AMR Results That are not Consistent With the GALL Report or not Addressed In the GALL Report

<u>Summary of Information in the Application</u>

In PNPS LRA Table 3.6.1, Summary of Aging Management Evaluations for the Electrical Components, the applicant provided information regarding components or material/environment combination in the GALL Report that it evaluated and identified as not applicable to its plant.

In PNPS LRA Table 3.6.2-1, the applicant provided additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report. Specifically, the applicant indicated, via Notes F through J, that neither the identified component nor the material/environment combination is evaluated in the GALL Report and provided information concerning how the aging effect requiring management will be managed.



<u>Project Team Evaluation</u>

The project team reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

<u>Aging Effect/Mechanism in Table 3.6.1 That Are Not Applicable for PNPS</u>

[This section is for write-up of the AMR line-items that the applicant claims are not used or not applicable to its plant in LRA Table 1. The write-up does not include the "further evaluation required" in Table 1 since they are evaluated in Section 3.[Y].2. In addition, the evaluation is not necessary if the plant is of a different vintage (PWR vs. BWR)]

The project team reviewed PNPS LRA Table 3.6.1, which provides a summary of aging management evaluations for the electrical components evaluated in the GALL Report.

In PNPS LRA Table 3.6.1 Item 3.6.1-6 discussion column the applicant states that fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation of fuse holders (not part of a larger assembly) metallic clamp is not applicable to PNPS because a review of PNPS documents indicates that fuse holders using metallic clamps are either part of an active device or located in circuits that perform no intended function. Therefore, fuse holders with metallic clamps at PNPS are not subject to aging management review at PNPS.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the Electrical Components at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.6.1 Item 3.6.1-11 discussion column the applicant states that the degradation of insulation quality due to presence of any salty deposits and surface contamination; loss of material caused by mechanical wear due to wind blowing on transmission conductors for high voltage insulators is not applicable to PNPS because High voltage insulators supporting conductors that provide recovery of offsite power following SBO include those associated with the switchyard bus located between switchyard breakers 352-2 / 352-3 and startup transformer X4. High voltage insulators associated with this path are subject to aging management review.

Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination in most areas is washed away by rain. The glazed and coated insulator surface aids this contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. PNPS is located near the seacoast where salt spray is considered. However, salt spray buildup is a short-term concern based on local weather conditions (event-driven). Under conducive weather conditions, salt buildup occurs in a matter of hours or days. Therefore, surface contamination is not an applicable aging mechanism for highvoltage insulators at PNPS.



Mechanical wear is an aging effect for strain and suspension insulators in that they are subject to movement. Wear has not been apparent during routine inspections. If left unmanaged for the period of extended operation surface rust would not cause a loss of intended function and thus, is not a significant concern. Loss of material due to wear will not cause a loss of intended function of the insulators. Therefore, loss of material is not an aging effect requiring management for insulators.

There are no aging effects requiring management for high-voltage insulators.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the Electrical Components at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.6.1 Item 3.6.1-12 discussion column the applicant states that the loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; and increased resistance of connection due to oxidation or loss of preload for transmission conductors and connections; switchyard bus and connections is not applicable to PNPS because transmission conductors are subject to aging management review if they are necessary for recovery of offsite power following a Station Black out (SBO). However, PNPS does not use transmission conductors in the circuits for recovery of offsite power following an

SBO. Other transmission conductors are not subject to aging management review since they do not perform a license renewal intended function.

The switchyard bus is uninsulated, un-enclosed, rigid electrical conductors used in medium and high voltage applications. The switchyard bus includes the hardware used to secure the bus to high-voltage insulators. The switchyard bus establishes electrical connections to disconnect switches, switchyard breakers, and transformers to support recovery of offsite power following SBO.

Connection surface oxidation for aluminum switchyard bus is not applicable since switchyard bus connections requiring AMR are welded connections. For ambient environmental conditions at PNPS, no aging effects have been identified that could cause a loss of intended function for the period of extended operation. Vibration is not applicable since flexible connectors connect switchyard bus. Therefore, there are no aging effects requiring management for aluminum switchyard bus.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the Electrical Components at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.



In PNPS Table 3.6.1 Item 3.6.1-13 discussion column the applicant states that the loosening of bolting connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation of the metallic parts of cable connections is not applicable to PNPS because cable connectors outside of active devices are taped or sleeved for protection. Operating experience with metallic pins on electrical cable connections at PNPS indicated no aging effects requiring management.

[The project team evaluation, if applicable]

On the basis that there [is/are] no [list of applicable components] in the Electrical Components at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

[Repeat the above three paragraphs, if applicable, for all items that the applicant claims is not applicable to its plant]

[If there are RAIs or issues that affect all Tables, provide discussion and evaluation here]

[If the LRA lists a series of components which have no aging effect and therefore do not require aging management, the following writeup may be used, as appropriate.]

<u>Electrical Components AMR Line Items That Have No Aging Effect (PNPS LRA Table 3.6.2.1)</u>

In LRA Tables 3.6.2-1, the applicant identified AMR line-items where no aging effects were identified as a result of its aging review process. Specific instances in which the applicant states that no aging effects were identified occurred for the following components, fabrication materials, and environments.

- Various metal components used for electrical connections that are exposed to indoor and outdoor air environments require no AMR. The aging effect in NUREG-1801 Vol 2 for this component, material, and environment is not applicable to PNPS.

On the basis of its review of current industry research and operating experience, the project team found that [environments] on [materials] will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for [materials] components exposed to [list of environment] environments.

- High-voltage insulator components (for SBO) manufactured from porcelain, galvanized metal and cement and exposed to a outdoor weather environment require no AMR because the aging effect in NUREG-1801 for this component, material, and environment is not applicable to PNPS.

On the basis of its review of current industry research and operating experience, the project team found that [environments] on [materials] will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for [materials] components exposed to [list of environment] environments.



- Switchyard bus (for SBO) connections fabricated from aluminum and/or copper exposed to an outdoor weather environment does not require and AMR because the aging effect in NUREG-1801 for this component, material, and environment is not applicable to PNPS.

On the basis of its review of current industry research and operating experience, the project team found that [environments] on [materials] will not result in aging that will be of concern during the period of extended operation. [provide project team evaluation] Therefore, the project team concluded that there are no applicable aging effects requiring management for [materials] components exposed to [list of environment] environments.

On the basis of its audit and review of the applicant's program, the project team found 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).

3.6.2.3.1 <u>Electrical Components - Summary of Aging Management Evaluation - PNPS LRA Table 3.6.2-1</u>

The project team reviewed the PNPS LRA Table 3.6.2-1, which summarizes the results of AMR evaluations for the Electrical Component groups.

In LRA Table 3.6.2-1, the applicant proposed to manage [list aging effect] of [list materials] materials for components types of [list component names] exposed to [list environments] environment using PNPN AMP B [NUMBER], " [Name of PNPS AMP]."

The project team reviewed [Applicant AMP Name] program and its evaluation is documented in Section [3.0.3.A.A] of this audit and review report. [Briefly provide summary of the program and the project team evaluation]. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of [list aging effect] of [List Material] material exposed to [List Environment] environment are effectively managed using [Applicant AMP Name] program. On this basis, the project team found that management of [list aging effect] in [table title] is acceptable.

<u>Conclusion</u>

On the basis of its review, the project team found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not addressed in the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.6.3 Conclusion



On the basis of its review, the project team concluded that the applicant has demonstrated that the aging effects associated with the electrical components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable UFSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of electrical components, as required by 10 CFR 54.21(d).

# Attachments

**Pilgrim Nuclear Power Station Audit and Review Report**

**Attachment 4**

**Disposition of Requests for Additional Information, LRA Supplements, and Follow up or Confirmatory Items**

**Requests for Additional Information**

[The following format should be used: RAI-[Audit and Review Report Section] - X, where X indicates the item to be confirmed for that section, for example RAI - 3.1.2.3.2-1]

| RAI No. | Description | Disposition |
|---|---|---|
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| | | |

**LRA Supplements**

By letter dated [MONTH DATE, YEAR] (MLXXXXXXXXX) the applicant submitted an LRA supplement in response to onsite audits of the aging management programs and aging management reviews. This LRA supplement provides disposition for all docketed audit findings and addresses future commitments, as stated in Attachment 6 of this audit and review report.

[Use the following paragraph if appropriate to identify additional supplements.]

[By letter dated [MONTH DATE, YEAR] [(MLXXXXXXXXX)] , the applicant submitted an additional LRA supplement in response to onsite audits of the aging management programs and aging management reviews. This LRA supplement provides additional disposition for docketed audit findings and addresses future commitments, as stated in Attachment 6 of this audit and review report. Any followup items that could not be closed out at the time this audit and review was conducted are identified below.]

**Follow up Items**

[The following format should be used: [Audit and Review Report Section] - X, where X indicates the item to be followed for that section, for example 3.1.2.3.2-1]

| Follow up Item No. | Description | Closed to RAI (RAI Issue) |
|---|---|---|
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**Confirmatory Items**

[The following format should be used: [Audit and Review Report Section] - X, where X indicates the item to be confirmed for that section, for example 3.1.2.3.2 -1]

| Follow up Item No. | Description | Closed to RAI (RAI Issue) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

**Pilgrim Nuclear Power Station Audit and Review Report**

## 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 on this list does not imply that the project team reviewed the entire document, but, rather that selected sections or portions of the documents were reviewed as part of the overall effort documented in this audit and review report. In addition, inclusion of a document in this list does not imply NRC acceptance of the document.

| Applicant's Aging Management Program | | GALL Report Aging Management Program | LRA-AMP Basis Document and Other Documents Reviewed |
|---|---|---|---|
| Boraflex Monitoring Program | B.1.1 | | |
| Buried Piping and Tanks Inspection Program | B.1.2 | | |
| BWR CRD Return Line Nozzle Program | B.1.3 | | |
| BWR Feedwater Nozzle Program | B.1.4 | | |
| BWR Penetrations Program | B.1.5 | | |
| BWR Stress Corrosion Cracking Program | B.1.6 | | |
| BWR Vessel ID Attachment Welds Program | B.1.7 | | |
| BWR Vessel Internals Program | B.1.8 | | |
| Containment Leak Rate Program | B.1.9 | | |
| Diesel Fuel Monitoring Program | B.1.10 | | |
| Environmental Qualification (EQ) of Electric Components Program | B.1.11 | | |
| Fatigue Monitoring Program | B.1.12 | | |
| Fire Protection - Fire Protection Program | B.1.13.1 | | |
| Fire Protection - Fire Water System Program | B.1.13.2 | | |
| Flow-Accelerated Corrosion Program | B.1.14 | | |
| Heat Exchanger Monitoring Program | B.1.15 | | |
| Inservice Inspection - Containment Inservice Inspection (CII) Program | B.1.16.1 | | |
| Inservice Inspection - Inservice Inspection (ISI) Program | B.1.16.2 | | |
| Instrument Air Quality Program | B.1.17 | | |
| Metal-Enclosed Bus Inspection Program | B.1.18 | | |
| Non-EQ Inaccessible Medium-Voltage Cable Program | B.1.19 | | |

**Pilgrim Nuclear Power Station Audit and Review Report**

| Applicant's Aging Management Program | | GALL Report Aging Management Program | LRA-AMP Basis Document and Other Documents Reviewed |
|---|---|---|---|
| Non-EQ Instrumentation Circuits Test Review Program | B.1.20 | | |
| Non-EQ Insulated Cables and Connections Program | B.1.21 | | |
| Oil Analysis Program | B.1.22 | | |
| One-Time Inspection Program | B.1.23 | | |
| Periodic Surveillance and Preventive Maintenance Program | B.1.24 | | |
| Reactor Head Closure Studs Program | B.1.25 | | |
| Reactor Vessel Surveillance Program | B.1.26 | | |
| Selective Leaching Program | B.1.27 | | |
| Service Water Integrity Program | B.1.28 | | |
| Structures Monitoring - Masonry Wall Program | B.1.29.1 | | |
| Structures Monitoring – Structures Monitoring Program | B.1.29.2 | | |
| Structures Monitoring – Water Control Structures Monitoring Program | B.1.29.3 | | |
| System Walkdown Program | B.1.30 | | |
| Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program | B.1.31 | | |
| Water Chemistry Control - Auxiliary Systems Program | B.1.32.1 | | |
| Water Chemistry Control – BWR Program | B.1.32.2 | | |
| Water Chemistry Control - Closed Cooling Water Program | B.1.32.3 | | |

| Applicant's AMR Sections and Systems for PNPS | PNPS LRA-AMR Basis Document and Other Documents Reviewed |
|---|---|
| 3.1 Reactor Vessel, Reactor Internals, and Reactor Coolant Systems | |
| 3.2 Engineered Safety Features Systems | |
| 3.3 Auxiliary Systems | |

Pilgrim Nuclear Power Station Audit and Review Report

| Applicant's AMR Sections and Systems for PNPS | PNPS LRA-AMR Basis Document and Other Documents Reviewed |
|---|---|
| 3.4 Steam and Power Conversion Systems | |
| 3.5 Structures and Component Support System | |
| 3.6 Electrical Components | |

## Attachment 6
## List of Commitments

[This attachment should list and summarize **ALL** commitments made by the applicant in the LRA that were reviewed by the project team, including any new commitments that the applicant made in response to the project team's audit and review. This list should include the identification of the commitment via a commitment number, as referenced in the body of the audit and review report. This information can be subsequently excerpted for the safety evaluation report (SER).

For commitments that were made in the LRA, the applicant's commitment numbering system in the LRA should be used. If the applicant revised its commitments in response to the project team's audit and review, provides a short description of the original commitment and the revised commitments. Again, the applicant's commitment numbering system should be used.

For commitments that the applicant made in response to the project team's audit and review and the applicant did not provide a numeric designation, the following format should be used: Audit and Review Report Section - X, where X indicates the commitment for that section, for example 3.1.2.3.2-1 for the first commitment in that seciton.]

| Commitment No. | Audit and Review Report Section | Description |
|---|---|---|
| | | |
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## Document Review Comment Form

Document Title: **Audit and Review Report for Plant Aging Management Reviews and Programs for Pilgrim Nuclear Power Station**

Area of Review: **Aging Management Audit Report Section 1. "Introduction and General Information" to Section 3.0.3.3.6.3 "Conclusion."**

**Reviewer Guidelines:**

1. Review for specific area of responsibility and/or expertise.
2. Direct comments to the actions within the scope of the document.
3. Record comment on this form. List page number and line number from document to identify location of proposed change. If comment is extensive or you have marked-up the document, make a notation on this form (e.g., "See comments on markup copy of document.") and return both this form and the marked-up document to the comment coordinator.
4. If information is technically correct, do not change because of personal style preference. You may, however, indicate clearer or more concise wording.
5. If you consider the comment critical and require that you review the revised document before it is approved, put a "Y" in the "Critical Comment" box.

| Comment No. | Page No. | Line No. | Comment | Critical Comment? | Comment Resolution |
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